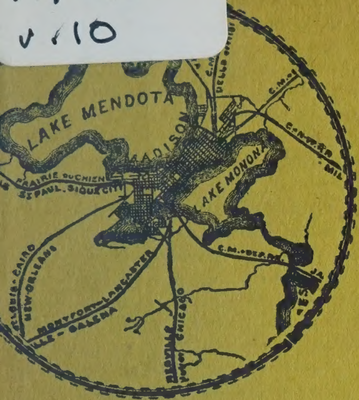


TENTH ANNUAL REPORT

OF THE

City Water Works

MADISON, WISCONSIN

1892

Compliments of

John B. Heim,

Superintendent.

TENTH ANNUAL REPORT

OF THE

BOARD OF

Water Commissioners

OF THE

CITY OF MADISON.

FOR THE YEAR ENDING SEPTEMBER 30, 1892.

TOGETHER WITH

THE REPORTS OF SUPERINTENDENT AND SECRETARY AND

RULES AND REGULATIONS.

MADISON, WIS.:
TIMES PRINTING COMPANY,
1893.

OFFICERS OF THE WATER WORKS.

WATER COMMISSIONERS.

JOHN LAMONT, President, - -	Term Expires October 1, 1893.
HENRY CHRISTOFFERS, - -	Term expires October 1, 1894.
JOHN R. MELVIN, - - -	Term expires October 1, 1895.
W. H. ROGERS, - - - - -	Mayor, *ex officio.*
HENRY SCHULKAMP, - - -	Alderman, *ex officio.*

JOHN F. DONOVAN, Secretary.

SUPERINTENDENT.

JOHN B. HEIM.

METER INSPECTOR.

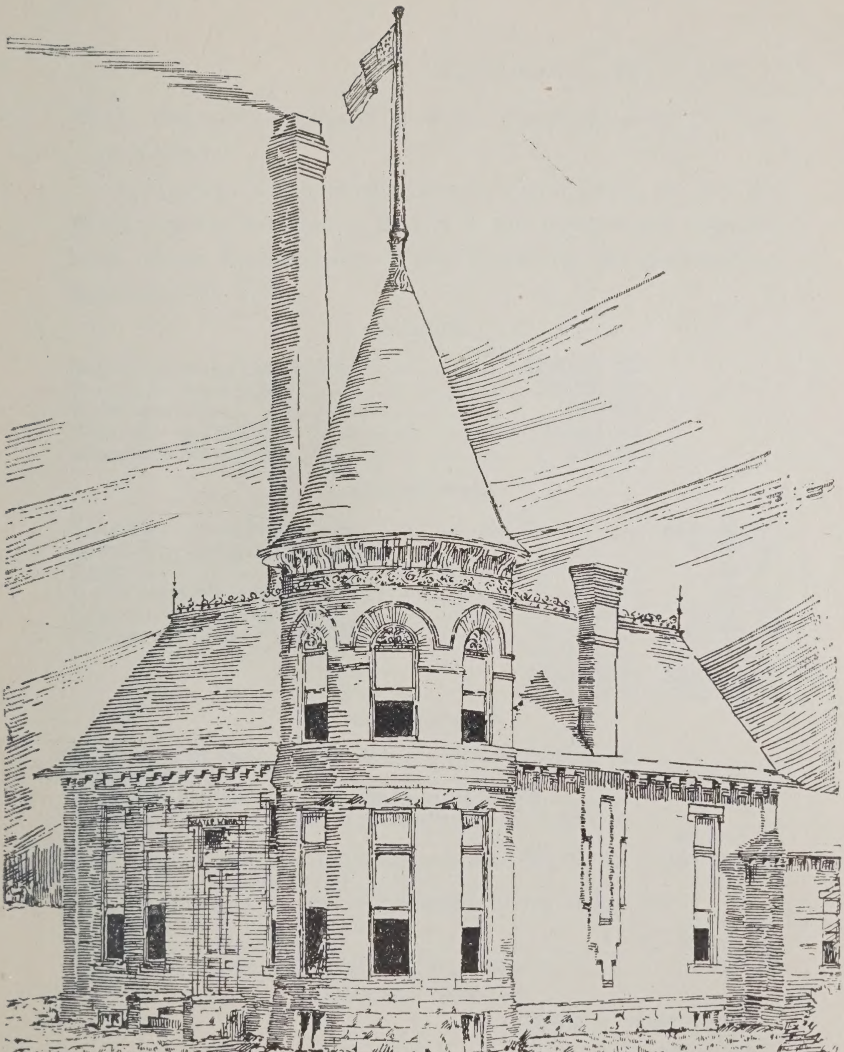
NICKOLAS REIF.

ENGINEERS.

PETER GAUER,
JOHN KELLY,
DENNIS DACEY.

FIREMAN.

PATRICK DORIS.



BINNER ENGR. MADISON · CITY · PUMPING · STATION · GORDON & PAUNACK, ARCHTS

MADISON, WIS., Feb. 1, 1893.

To the Honorable, the Board of Water Commissioners of the City of Madison:

GENTLEMEN: — I have the honor of submitting to you the Tenth Annual Secretary's Report of the receipts and expenditures of the Madison City Water Works for the year ending September 30, 1892:

RECEIPTS.

Balance on hand Oct. 1, 1891	$10,870 47	
Water rates collected	15,020 83	
Water permits	310 00	
From tax of 1891	8,500 00	
Miscellaneous receipts	177 47	

EXPENDITURES.

Construction expenses		$14,180 10
Operating expenses		8,827 90
Repairs		44 67
Water rates refunded		50 36
Transferred to sinking fund		5,000 00
Balance on hand Oct. 1, 1892		6,775 74
	$34,878 77	$34,878 77

MISCELLANEOUS.

Total receipts from water rates since construction of Works to Oct. 1, 1892	$112,526 07
Total receipts from water permits same period	3,302 00
Total operating expenses from beginning of works to Oct. 1, 1892	82,631 81
Total cost of extension and construction to Oct. 1, '92.	241,118 29
Total cost of repairs to Oct. 1, 1892	2,121 17
The bonds issued for the construction of the Water Works were	76,000 00
Bonds now outstanding	32,000 00
The annual interest on the same at 5 per cent. is	1,600 00

Respectfully submitted,

JOHN F. DONOVAN,
Secretary.

Report of the Commissioners.

To the Honorable, the Common Council:

GENTLEMEN: — In compliance with the provisions of the charter, we herewith submit our annual report of the Madison City Water Works for the year ending Sept. 30, 1892. For figures showing receipts and disbursements during the past year we refer you to the report of the Secretary, which also contains statements of the receipts, expenditures, total cost of construction, etc., from the building of the works up to date. A net surplus of receipts over expenses amounting to $33,143.90 is an indication of the flourishing condition of the Water Works. The bonded indebtedness of $76,000 has been reduced to $32,000, and within a few years will be wiped out altogether.

This condition cannot fail to be satisfactory to you, as it is extremely gratifying to us, and we can also congratulate the citizens of Madison on their having one of the lowest water and meter rates in existence, and a system of Water Works that is economically and honestly managed.

We invite a careful perusal of the very able and comprehensive report of the Superintendent. The splendid condition of the Works — financial and otherwise — is the result of his indefatigable labors and conscientious discharge of duty at all times and under all circumstances, and we fully concur in all of his recommendations. We will proceed at once to have one or more wells drilled, as our water supply is at times inadequate to meet the demands made upon it.

The meter system is constantly growing in favor and is being constantly extended, as consumers readily see the justice of paying for exactly the amount of water they use.

During the past season water was furnished to sprinkling carts free, our aim being to lessen the expense to property owners

where sprinkling was done. No reduction in rates followed, however, and as the cost of repairing hydrants was very much increased by the move, the practice has been abandoned, and next season the water will be charged for as in the past.

We regret very much that your honorable body made no provision for the water fund for the coming year, which will be to us one of the most important since the construction of the works, as large expenditures are to be made, with less money at hand than in former years.

We ask your hearty co-operation and that of our citizens in helping us to successfully carry on the work assigned us. Our efforts will be in the future, as in the past, to work with an earnest endeavor for the constant and increased success of the Madison City Water Works.

Very respectfully,

JOHN LAMONT.
HENRY CHRISTOFFERS.
JOHN R. MELVIN.
WM. H. ROGERS.
HENRY SCHULKAMP.
Board of Water Commissioners.

Madison, Wis., Feb. 8, 1893.

Superintendent's Report.

MADISON, WIS., February 1, 1893.

In obedience with the provisions of the ordinance, I herewith present the Tenth Annual Report of the Madison City Water Works upon its condition, the additions and improvements that have been made during the past year, its progress, and such recommendations as are deemed necessary.

CONDITION.

The condition of the plant is splendid, and reflects credit upon the engineers for the care and interest taken. Continuous care and watchfulness has been practiced to keep mains constantly flushed, endeavoring to furnish patrons with the best of water, to conduct the Water Works impartially, and on a strict business basis, to keep everything in good working order and repair, to manage with the best interest for the citizens in view, and to practice economy with all moneys entrusted, which the secretary's report will prove. During the cold weather hydrants were daily examined so that no fault shall be found with the department in case of fire.

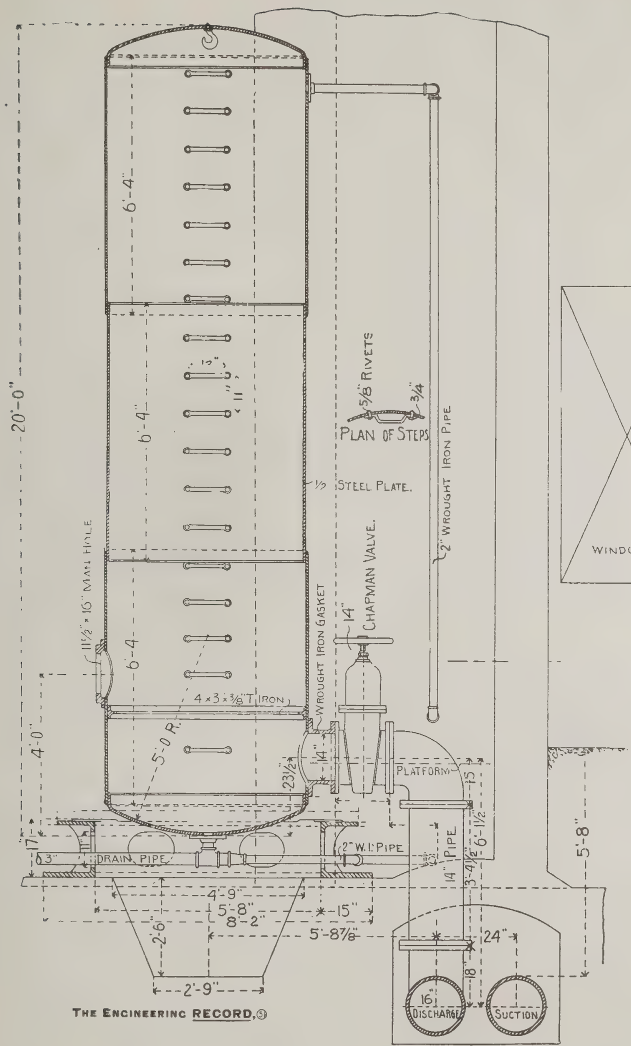
IMPROVEMENTS.

During last year vacuum chambers were placed on both engines near the inlet valves of the suction pipes at the pumps, to greatly facilitate and assist in the drawing of water from the wells, enabling them to maintain a steady flow with a greater suction, and permiting a more rapid running of pumps than was permissible heretofore. The roof of the boiler room and coal house was repaired and covered with asbestos roofing.

AIR CHAMBER.

In 1885 we recommended for your consideration an air chamber to relieve the violent fluctuations of pressure on account

of our elevations and direct system, but on account of the excessive use of water and the adoption of the meter system, delayed matters until last year, when you decided to construct the same. As per your instructions, and upon consultation with Edwin Reynolds, M. Am. Soc. M. E., as to the design and modus operandi, a contract was entered into with E. P. Allis & Co., of Milwaukee to build the air chamber. The accompanying cuts illustrate the same. It is made of triple riveted one-half inch steel plate, five feet in diameter and 20 feet high, and is able to carry a safe working pressure of 200 pounds, and is connected as near to the pumps as it could possibly be placed with the 16-inch delivery main and a 14-inch main to the chamber where a 14-inch valve is placed, to cut off should occasion demand it. As our variableness in pressure is up to and about 40 pounds, and in cases of fire, breaking of hose, flushing of mains, use of hydrants for sprinkling carts, the sudden closing of a hydrant, or the use of a water motor, causing violent strains on the machinery, mains, services and fixtures, your honorable body, decided to overcome the difficulty. This air chamber provides a temporary relief from these sudden variations in pumpage and violent changes in pressure. At ordinary working pressures the chamber is filled with air. During a rise in pressure from 75 to 150 pounds the chamber takes in about 200 cubic feet of water and the expansive force of the air in the chamber promptly returns this water to the mains, in case of any sudden demand for water, beyond the capacity of the pumps, at the speed at which they may be running, and gives time to gradually increase their speed to the requirements of the service, and in case of a sudden reduction in quantity caused by the closing of hydrants, causing a diminution in the draught, the chamber is again able to take up the corresponding excess of water, giving the engines time to come down to their normal speed without strain, shock or danger of breakage. This air chamber is available at all times whether we carry domestic or fire pressure, as a source of immediate supply, and affords a great relief to the violent fluctuations of pressure at such times, it is efficacious in all its in-



20'-0"
6'-4"
6'-4"
6'-4"
4'-0"
5'-0 R.
11½" × 16" Man Hole
4 × 3 × ⅜" T Iron
⅝" Rivets
¾
Plan of Steps
½ Steel Plate.
2" Wrought Iron Pipe
Chapman Valve.
14"
Wrought Iron Gasket
Window
Platform
23½"
14"
15
6'-1½
3'-4½"
14" Pipe
2" W.I. Pipe
Drain Pipe
3"
17"
4'-9"
5'-8"
8'-2"
15"
5'-8⅞"
2'-6"
2'-9"
24"
18"
16"
Discharge
Suction
5'-8"
The Engineering RECORD.

Fig. 1.

tents. At the bottom is a three inch drain pipe and a two inch feed pipe to a small receiver which has a set of valves so designed that it can be relieved of the pressure in the air chamber and the water exhausted from it when it will fill with air. By changing the position of the lever shown on the side, see fig. 2 on accompanying cut, the air contained in this receiver will then be forced into the air chamber by the water flowing from the latter to the former. The necessity of placing the air chamber near the pumps and just outside of the main building, required an enclosure and led to the addition of a small circular tower at south corner, as shown in the accompanying cut, fig. 3. The foundation is nine feet seven inches, including a concrete bed of two feet on which is placed three feet three and one-half inch large flag-stones on which rests the air chamber. The annex or tower building is 68 feet to flag staff, which is 19 feet high, is of white brick and Madison stone trimmings to correspond with main building, an iron stairway leads from the main gallery floor of the engine room down to the basement and up to the private office in the second story. Gordon and Paunack of our city are the architects.

WATER.

We are gradually increasing our water takers, having added during the past year 149, which makes to date, Sept. 30, 1892, 1,554 and 22 more again on file to be added the latter part of this year, we will soon have reached our limited supply of water. The serious question of *more water* arises. Through the meter system this difficulty has been overcome thus far, having pumped only on an average 646,673 gallons per day the last year, against 546,120 gallons per day for 699 water takers before the meter system was adopted. I would therefore recommend that the city contract for three more wells during the coming season, locating one at the corner of Mifflin and Livingston streets, one at the corner of Main and Paterson, and one at the corner of Brearly and Wilson streets. These are 1,000 feet apart, and direct east from other wells, and in conformity with current running north and south, and as per recommendation of

Prof. T. C. Chamberlain, late chief geologist of the state of Wisconsin, to locate wells direct east and west. The first well ought to be drilled and connected with the system before the first of July, 1893.

METERS.

We now have 547 meters connected with the service, having added 49 during the last year. We have been unable to add meters on all services that pay $8.00 and over, as per your instruction, on account of shortage of funds, being obliged to use amount on construction fund, for repair of water tower, connecting air chamber, service connections, laying of new water mains and expending $1,261.77 for meters, as they are free to the water takers. The meter system gives entire satisfaction, there is a continuous call for them, and water rent is lower, with the exceptions of a few instances where patrons insist upon wasting. It is the problem solved of saving water. An unnoticeable leak is detected, wastefulness guarded. We have adopted with the taking of the record of the meter each month, a system, to notify patrons at once, in case we find an unusual excess of water used, since the last reading, to prepare takers against an unbeknown large water bill at the next rent day, and to prevent further waste and have leak repaired. As for the benefits derived by the water takers through the meter system, I will quote a few illustrations, giving amount previously paid per annum by same parties under schedule rate, and amount paid last year under meter rate.

Patron	paid under	schedule rate............	$276 00	under meter	$225 14
"	"	"	149 30	"	63 96
"	"	"	129 00	"	47 50
"	"	"	109 90	"	49 18
"	"	"	80 00	"	52 10
"	"	"	77 50	"	63 96
"	"	"	65 00	"	37 94
"	"	"	44 00	"	33 87
"	"	"	32 50	"	22 57
"	"	"	30 50	"	18 89
"	"	"	28 50	"	7 40
"	"	"	25 50	"	17 11

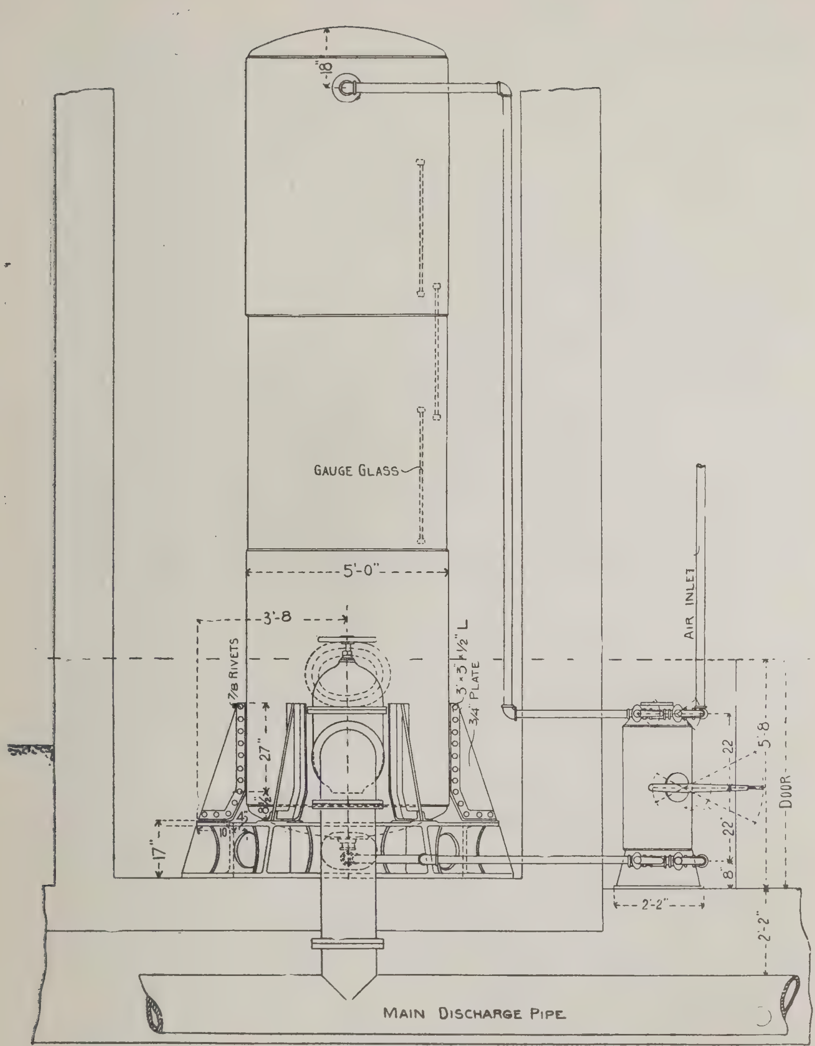

18"
GAUGE GLASS
5'-0"
3'-8
7/8 RIVETS
3"×3"×1/2" L
3/4" PLATE
27"
8 1/2"
4"
10"
17"
AIR INLET
22
22'
5'8
8"
DOOR
2'-2"
2'-2"
MAIN DISCHARGE PIPE

Fig. 2.

Patron paid under schedule rate...........	22 50,	under meter	$ 11 83
" " "	19 50	"	11 99
" " "	15 50	"	5 16

The four greatest amounts paid for water by meter was, viz: Park Hotel, $540.42; Gas Co., $263.23; Hausmann Brewing Co., $259.81; and Fauerbach Brewing Co., $131.48. We pumped during the year 236,035,800 gallons of water; the estimated amount wasted in flushing mains was 4,200,000; amount used by sprinkling carts 3,024,000. The 547 water takers consumed through meter 63,362,611 gallons, 115,000 gallons were pumped for fire, allowing 4,000,000 gallons for leaks and wasting during laying of new mains, etc. For five drinking fountains and three jet fountains, estimated use 2,416,400 gallons; schools, churches and public buildings, estimated use 5,400,000; leaves a balance of the 1,007 water takers for unmetered water consumed of 153,517,789 gallons. The 547 water takers used on an average 317½ gallons per day, and paid $8,892.58, and the 1,007 water takers used on an average 413 gallons per day, and paid $6,127.25. We pumped 48 gallons per capita.

METER RATES.

In 1891, previous to collecting water rents, your honorable body reduced and adopted new meter rates, on a basis calculated to make a reduction to every taker, but the question has been raised that those rates were not just, and that it required patrons to use a greater quantity of water to derive the benefit and that takers were stinting themselves in the use of water. After a careful examination I found that only 39 patrons taking metered water used over 5,000 cubic feet and up to 10,000 cubic feet during six months; only three takers used over 15,000 and up to 20,000 cubic feet during the same period; and only two takers over 25,000 and up to 30,000 cubic feet during six months. These 44 patrons paid for the year 1892, notwithstanding that some reached 9,000 cubic feet, $831.55, whereas previous to the adoption of the meter system they paid under the schedule rates $1,250.20, a difference in their favor of $418.65. Again, of the 45 patrons, eleven paid more than under

schedule rates, on account of leaks, and allowing water to run, these were the parties that reached the greatest number of cubic feet under the three grades, and they paid the city for metered water $284.43, under schedule rate, would have paid $223.15, a difference of $61.28. Thus it will be seen that the meter rates where as near right as they possibly could be made. This same calculation was the basis upon which you had fixed the meter rates. Your endeavors are to treat water takers as near just as possible and to obviate any injustice that might be done, I would recommend that you adopt a revised meter rate graded for each 1,000 cubic feet over and above 5,000 cubic feet per six months.

WATER PERMITS.

During the year ending Sept. 30, 1892, I have issued 149 original and 89 extension permits, making total takers to date 1,554.

WATER RENTS.

The annual revenue of the 1,554 water takers was $15,020.83, water permits, $310.00. Total, $15,330.83, only $41.43 less than the previous year, after a reduction had been made in the meter rates of over $2,000. The average for each taker was $9.86½, against $10.77⅛ last year.

OPERATING EXPENSES.

The operating expenses for the year ending Sept. 30, 1892, was $8,827.90 against $8,052.24, being obliged to pay $1.01 per ton of coal more than the previous year. We used the Anthracite Pea coal, contracted for with N. H. Dodge at $5.95 per ton. Coal will be still higher this year. The surplus reached the sum of $6.316.36.

CONSTRUCTION EXPENSES.

The construction, repairs, meters, extensions and improvements for the year ending Sept. 30, 1892, was $14,180.10, repairs, $44.67.

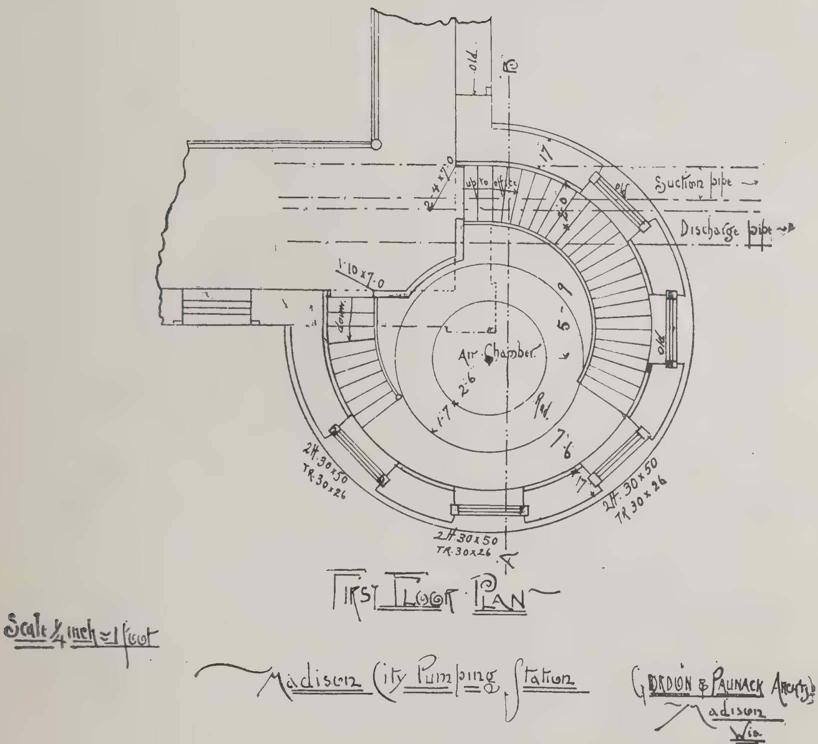

Suction pipe
Discharge pipe
Air Chamber
old
up to office
down
2' 4 x 7' 0
1' 10 x 7' 0
2 lt. 30 x 50
TR. 30 x 26
First Floor Plan
Scale ¼ inch = 1 foot
Madison City Pumping Station
Gordon & Paunack Archts.
Madison
Wis.

FIG. 3.

WATER FUND.

Section 6, chapter 244 of the laws of 1889, provides that a sum equal to three-tenths of one per cent. of the assessed valuation of the real and personal property of the city, or such less sum as the board of water commissioners may by resolution determine to be sufficient, at a meeting of said board prior to the time of the levy of the tax by the common council of the city, as specified, shall be set apart to the Water Works fund, which would mean $19,544.80 or such sum less as commissioners decide. No notice of meeting was given, no meeting called for the water commissioners to designate the amount they would require the coming season, and therefore no fund was provided for, leaving Water Works construction and extensions with no funds at command, except the surplus over and above the operating expenses. Our balance on hand Oct. 1, 1892, was $6,775.74, received for water rents till Feb. 1, 1893, $6,278.50, for pipe and permits, $73.00. Total, $13,127.24. Cash paid for new mains, service connections, air chamber, meters, etc., from Oct. 1, 1892 to Feb. 1, 1893 was $10,349.44, leaving only a balance the first day of February, 1893, of $2,777.80. You are compelled to sink another well which will cost with suction pipe to be laid, at least $6,000, service connections $1,000, meters $1,200, a mile of new mains is already called for, $3,000. On air chamber building there is yet due $1,600, a pipe yard has to be provided for which will cost $2,000, operating and incidental expenses till Oct. 1, 1893, $4,000, making a sum total of $18,500, adding the anticipated water rents, July, 1893, of $8,700 will give us in round numbers' $11,500, a deficit of $7,000. This is a very important year, we cannot postpone these expenses, and if possible the common council should make provision for the deficiency.

PIPE AND STORAGE.

Your attention was called last year that ere long we would be obliged to look for other grounds to store our pipe, specials, hydrants, etc., the possibility of present rented grounds being sold, such as you are aware has already taken place, and we are

compelled to seek other grounds, I would therefore recommend that your honorable body provide at once for a building at the rear of the coal house, to conform with the appearance of the pumping station, to store the pipe and specials, hydrants, valves, service and valve boxes, etc., also provide in same building more storage room for coal, as the present building is inadequate to take in the amount required, and the scales can be placed at the same time under cover which are now exposed to the weather.

MONTHLY RECORD OF THE AMOUNT OF WATER PUMPED AND COAL CONSUMED DURING THE YEAR.

MONTHS.	Gallons of water pumped.	Revolutions of large engine.	Revolutions of small engine.	Aver'ge steam pressure.	Aver'ge water pressure.	Vacuum in wells in inches.	Pounds of coal consumed.	Ashes, in lbs.	Net combustibles.	Duty in foot lbs., per 100 lbs. of coal.
October, 1891	17, 913, 000	....	1, 368, 000	70	82	$14\frac{3}{8}$	83, 200	13, 312	69, 088	44, 022, 200
November, 1891	18, 411, 600	841, 500	....	70	82	15	107, 200	17, 120	90, 080	35, 231, 400
December, 1891	20, 974, 000	967, 000	....	70	82	$19\frac{1}{2}$	108, 300	17, 328	90, 972	38, 702, 900
January, 1892	20, 940, 500	619, 000	573, 500	70	82	$19\frac{1}{2}$	103, 700	16, 592	87, 208	40, 174, 400
February, 1892	16, 352, 000	....	1, 309, 000	70	82	14	88, 500	14, 160	74, 340	37, 699, 500
March, 1892	17, 056, 250	....	1, 388, 000	70	82	$14\frac{1}{2}$	77, 400	12, 384	65, 016	44, 640, 200
April, 1892	18, 180, 000	265, 000	996, 000	70	82	15	87, 800	14, 048	73, 752	42, 559, 200
May, 1892	18, 002, 250	93, 000	1, 268, 000	70	82	15	86, 800	13, 888	72, 912	42, 559, 200
June, 1892	18, 906, 250	80, 000	1, 390, 000	70	82	$16\frac{1}{2}$	94, 400	15, 304	79, 096	41, 946, 300
July, 1892	23, 555, 450	97, 500	1, 705, 500	70	82	24	112, 800	18, 048	94, 752	44, 733, 600
August, 1892	25, 952, 000	183, 000	1, 749, 000	70	82	24	116, 600	18, 656	97, 944	46, 835, 200
September, 1892	19, 792, 500	....	1, 587, 000	70	82	19	106, 400	17, 024	89, 376	39, 114, 000
Total	236, 035, 800	3, 146, 000	13, 334, 000	70	82	$17\frac{17}{32}$	1, 173, 100	187, 764	985, 336	*41, 488, 175

* Average.

Prepared by Chief Engineer Peter Gauer.

RECORD OF FIRES DURING THE YEAR.

DATE.	Time.	Duration.	Gallons of water for fires.	Pressure at station in lbs.	False Alarm.
Oct. 12, 1891	7:30 p. m.	30 m	24, 000	83	
Oct. 14, 1891	1:00 p. m.	15 m	6, 000	83	
Oct. 19, 1891	5:00 p. m.	20 m	8, 000	83	
Dec. 4, 1891	....	....	....	....	False alarm.
Dec. 8, 1891	5:00 p. m.	50 m	20, 000	80-85	
Dec. 14, 1891	....	....	....	....	False alarm.
April 12, 1892	2:50 p. m.	35 m	10, 500	65-70	
June 14, 1892	....	....	....	....	False alarm.
July 2, 1892	3:45 a. m.	30 m	12, 000	90	
July 2, 1892	....	....	....	....	False alarm.
July 15, 1892	....	....	....	....	False alarm.
July 15, 1892	2:00 p. m.	30 m	6, 000	80-85	
July 21, 1892	2:10 p. m.	10 m	2, 000	80-85	
July 27, 1892	....	....	....	....	False alarm.
July 29, 1892	4:10 p. m.	15 m	9, 000	80-100	
Aug. 11, 1892	....	....	....	....	False alarm.
Aug. 17, 1892	....	....	....	....	False alarm.
Aug. 18, 1992	8:45 p. m.	10 m	2, 000	80-85	
Aug. 19, 1892	3:00 p. m.	1 h 20m	35, 000	80-83	
Aug. 19, 1892	....	....	....	....	False alarm.
Aug. 19, 1892	....	....	....	....	False alarm.
Aug. 19, 1892	....	....	....	....	False alarm.
Sept. 15, 1892	9:05 a. m.	05 m	1, 000	80	
Total	....	....	....	....	....

Prepared by Chief Engineer Peter Gauer.

SUMMARY.

Population by census of 1890, 13,246.

Kind of Engines—Two non-condensing Reynolds-Corliss, with Knowles pumps combined.

Capacity—1,500,000 and 2,500,000 per day.

System—Direct pressure.

Source of water—Eight artesian wells.

Number of days pumped, 365.

Average pumping time per day, 24 hours.

Number of gallons pumped during year, 236,035,800.

Number of gallons pumped per month, 19,669,650.

Number of gallons pumped per day, 646,673.

Total number water takers, 1,554.

Daily average amount pumped for each water taker, 418 gallons.
Greatest amount pumped during the year, 1,018,750 gallons.
Smallest amount pumped during the year, 437,500 gallons.
Difference in consumption during the year, 581,250.
Number of gallons pumped for one cent of fuel, 670 6-10.
Average head pumped, in feet, 209.
Dynamic head on pump by guage pressure, 90 pounds.
Total revolutions of large engine during year, 3,140,000.
Total revolutions of small engine during year, 13,334,000.
Number of gallons pumped to one pound of coal, 201 35-100.
Total amount of coal cosumed during the year, 1,173,100 pounds.
Total amount of coal consumed in tons during the year, 586 1100-2000.
Total amount of coal consumed per month, pounds, 97,758.
Total amount of coal consumed per day, pounds, 3,214.
Total amount of coal consumed per hour, pounds, 134.
Total amount of coal per square foot of grate surface, 5 36-100.
Net combustibles during the year, in pounds, 985,336.
Net combustibles per month, in pounds, 82,111.
Net combustibles per day, in pounds, 2,700.
Net combustibles per hour, in pounds, 112½.
Net combustibles per square foot, grate surface, pounds, 4½.
Average non-combustibles per day, in pounds, 514 4-16.
Per cent. of non-combustibles, 16.
Kind of coal—Anthracite Pea.
Price of coal per ton, $5.95.
Cost of coal during the year, $3,489.97.
Cost of coal to raise 1,000,000 gallons 209 feet high, $14.78.
Cost of coal to raise 1,000,000 gallons one foot high, 7 1-14 cents.
Duty pounds of water raised one foot high with 100 pounds of net combustible coal, 41,488,175.

SERVICE CONNECTIONS.

April 15, 1892, the city entered into contract with Geo. Kraft to tap the mains and lay pipe to curbstone for the season of 1892. One hundred and thirty-nine taps were made for original services, and eighty-one taps to curbstone on streets being macadamized to premises in case a call for water is made hereafter, the streets will not have to be torn up and aid in destroying them, a total of 220. The following table shows on what streets services were laid the past year, size and number of feet on each street, and the total including the eighty-one services to premises laid not called for on macadamized streets.

During the year there has been laid 5,335 feet of services by the city, there being now $8^{390}/_{5280}$ miles.

TABLE.

Steeet or Avenue.	⅝-inch.	¾-inch.	1-inch.	1½-inch.	Total.
Blair	29				29
Blount	77				77
Bassett	29				29
Broom	86				86
Butler	193				193
Brearley	48				48
Bruen	15			112	127
Clymer	29				29
Canal	48				48
Caroll	48		29		77
Dayton	144				144
Doty	48				48
Fairchild	38				38
Francis	38				38
Gilman	481				481
Gorham	155				155
Hancock	105				105
Henry	162				162
Jenifer	135				135
Johnson	384		19		403
Julia	19				19
Lake	106				106
Livingston	38				38
Langdon		105			105
Mifflin		11		110	121
Main	48				48
Mary	19				19
Mendota Court	48	38			86
Monona Street	26			290	316
Murray	221				221
Park	29		19		48
Pinckney	68	11			79
Rutledge	19				19
Spaight	57				57
State	233	57			290
University Avenue	129	62			191
Williamson	70				70
Wilson	833				833
Wisconsin Avenue	28				29
Webster	29				28
W. Washington Avenue	160				160
Total	4472	284	67	512	5335

Complaints arose and justly so, the condition the tapper left the street after having placed the services on macadamized streets. It was impossible for the department to keep track where services were going in, it seemed notionable with the tapper, sometimes days would elapse before the department would discover that the tap had been made, we would compel him to have material replaced, and only with the greatest trouble and annoyance, did we partially succeed, again if tapping machine would fail to act, he would cut the water off unbeknown to the department and water takers, and several valves we found closed long after work had been done. These service connections are a continuous cause of trouble and annoyance when done under contract. I would therefore recommend that the city do its own tapping and laying of service pipes, even if at a greater cost, caused by extra pains taken on macadamized streets, and the city is then in position to have the work done as it ought to be done. City macadamized Johnson street without giving notice or time to the department to put in services before work was commenced. We therefore do not wish to be criticised for tearing up the street, whenever water is called for by property owners on that street.

NEW MAINS.

During the year we have laid 4,340 feet of four inch, and 650 feet of six inch, and 874 feet of two inch lead pipe in place of cast iron pipe, being one and $^{584}/_{5280}$ miles, located two hydrants and twelve valves. Pipe was furnished by Dennis Long & Co., Louisville, Ky.; Mathews Hydrant, R. D. Wood & Co,, Philadelphia, Pa.; Ludlow Valve, National Tube Works Co., Chicago, Ill.; valve and service boxes, A. W. Morgan Man'f'g Co., Buffalo, New York.

The following table shows the extensions made during the year, giving size, where laid and the number of feet; also where hydrants and valves were placed :

TABLE.

Street or Avenue.	4-inch.	6-inch.	No. of Pieces.	Hydrants.	Valves.	Lead Pipe.
S. Broom	336	....	28	....	1 4-in.	....
S. Bruen	....	....	....	....	....	112 $1\frac{1}{2}$-in.
S. Carroll	336	....	28	....	1 4-in.	....
S. Fairchild	420	....	35	....	1 4-in.	....
Fuller & Johnson Works, from Dayton St. to rear of shops, connected dead end.	648	....	54	1 4-in.	....	....
W. Gilman	840	....	70	....	2 4-in.	....
N. Hancock	1,008	....	90	....	3 4-in.	....
N. Henry	336	....	28	....	1 4-in.	....
Mendota Court	....	....	....	....	....	300 2 -in.
E. Mifflin	....	....	....	....	....	165 $1\frac{1}{4}$-in.
Monona	....	....	....	....	....	297 $1\frac{1}{2}$-in.
N. Paterson	336	....	28	....	1 4-in.	....
E. Williamson and part of		650			1 6-in.	....
Dickinson	80		61	1 4-in.	1 4-in.	....
Total	4,340	650	422	2	12	874

We now have 27 and $^{2602}/_{5280}$ miles of mains, 140 hydrants, 166 valves and eight and $^{390}/_{5280}$ miles of service connections.

Unjust criticism is made, that the department did not replace the material on macadamized streets when laying new water mains, and leave the street in as good condition as before disturbed. After snow has disappeared and upon investigation, your honorable body will find, that such statements are not true. The endeavor always was, and will be, to have the work performed in the best possible manner.

COMPARISON.

The question has been raised at divers times, through print and otherwise, that the splendid showing of the Madison City Water Works, was deceptive, not as good as given, in comparison, if the franchise had been given to the private company. I have prepared a table showing the actual outlay of the city in its

construction from Jan. 1, 1882, to Oct. 1, 1892, the receipts from water rents during same period and what the city would have been obliged to pay in hydrant rental during that time, five per cent. added in each case. The actual amount borrowed was $76,000, on which interest has been paid these ten years of $34,250. The total amount of bonds still outstanding is only $32,000, annual interest at five per cent. $1,600. The balance of expense on construction and extension was all paid in cash, by an annual taxation set aside for Water Works, and the receipts from water rents over and above the operating expenses. I have not brought the operating expenses in the consideration, as one would offset the other, and if anything would be less by the company on account of the city using hard coal in deference to the citizens living near and around the pumping station on account of soot and smut from soft coal, city having paid as high as $8.33 per ton for hard coal.

COMPARISON.

YEAR.	Amount to be Paid to Co., by City, 5 Per Cent. Added.			Actual Outlay by the City in Construction during same Period, 5 Per Cent. Added.			Receipts from Water Rents, 5 Per Cent. Added.		
	Cost to City if owned by Co.	Interest 5 per cent.	Total.	City paid for Construction.	Interest 5 per cent.	Total.	Amount Rec'd for Water.	Interest 5 per cent.	Total.
		From Jan. 1, '82.							
1882	....	....	....	$47, 876 52	$2, 393 83	$50, 270 35	....	....	....
1883	$10, 000 00	$833 28	$10, 833 28	34, 870 66	1, 743 83	36, 614 49	$3, 176 30	$158 81	$3, 335 11
1884	10, 500 00	525 00	11, 025 00	42, 990 45	2, 149 52	45, 139 97	7, 170 30	358 52	7, 528 82
1885	11, 250 00	562 50	11, 812 50	8, 471 40	432 57	8, 903 97	8, 738 06	436 90	9, 174 96
1886	12, 375 00	616 75	12, 991 75	17, 707 21	855 36	18, 592, 57	10, 715 36	537 77	11, 251 13
1887	14, 000 00	700 00	14, 700 00	16, 461 48	823 07	17, 284 55	13, 217 69	660 88	13, 878 57
1888	14, 750 00	737 50	15, 487 50	15, 294 80	764 74	16, 059 54	13, 783 40	689 17	14, 472 57
1889	15, 000 00	750 00	15, 750 00	18, 124 51	906 23	19, 030 74	13, 410 37	670 52	14, 080 89
1890	15, 250 00	762 50	16, 012 50	12, 865 37	643 27	13, 508 64	13, 136 43	656 82	13, 793 25
1891	15, 750 00	787 50	16, 537 50	7, 551 13	377 56	7, 928 69	15, 144 26	757 21	15, 901 47
1892	16, 750 00	....	16, 750 00	14, 180 10	....	14, 180 10	15, 020 83	....	15, 020 83
Total	$135, 625 00	$6, 275 03	$141, 900 03	$236, 393 63	$11, 119 98	$247, 513 61	$113, 513 00	$4, 924 60	$118, 437 60

Thus it will be seen that the city would have paid for hydrant rental to the company under the franchise, with five per cent. added, $141,900.03. It cost the city during the same period to construct, having now 27⅓ miles of water mains, $247,513.61 with five per cent. added, in *which is included $22,202.70 for service connections, no company furnishes these free to water takers, and $14,625.77 paid for water meters free to takers.* The city received from water rents, five per cent. added $118,437.60. It would have cost the city without water rents $105,613.58 more than she would have paid the company, deduct the water rents and there is a gain of $12,824.02 over company, deduct service connections and meters and the gain is $49,652.49, aside from the above our citizens get the water considerable cheaper than they would from the company, the annual expense by the city to the company on hydrant rental will steadily increase, as works grow, on the other hand it will gradually diminish, and the water takers get the benefit. The city in owning its water works is independent in its action, and if a call comes from our citizens for new mains where no hydrant is included, and of course no rental, the city proceeds and gives them water. Again, if we calculate on the amount it cost the city for construction, and deduct the amount received through water rents, the city would have paid $129,076.01 for $247,513.61 capital invested, whereas on the contrary if company owned the works, the city would have paid $141,900.03 and owned nothing, the company would have collected the water rents, and if at same low rates as city furnished water, would have received $260,337.63, if the cost of construction would have been the same as to city, the works would have been paid in ten years, and a surplus on hand of $12,824.02. Next year if not a foot of pipe would be laid by company, the city would have to pay under franchise $15,773.04. Ought not the city always cherish the memory of the common council of 1881–2, in building its own Water Works ?

CONCLUSION.

We have now completed the tenth year of the existence of our Water Works, they have grown steadily in the estimation of

our citizens, in their efficiency. magnitude, and pride of our beautiful city, and stand in the foremost ranks of water departments. Your honorable body entrusted with its management, can feel well repaid by the success, for your arduous zeal and endeavors for the success of the Madison City Water Works.

Allow me to express my gratitude to each member of the board, for the wise counsel, ready assistance and cheerfulness given. My endeavors shall be as in the past, to perform the duties entrusted in a manner that shall at all times meet with your approbation and that of our citizens.

In conclusion, I desire also to express my satisfaction and appreciation to the meter inspector, secretary, engineers and fireman for the ever willing, prompt and faithful discharge of their several duties, all imbued with the same aim, the success and prosperity of the Water Works.

Respectfully submitted,

JOHN B. HEIM,

Superintendent.

FIRE ALARM.

Signal by the whistle of pumping station is as follows :

First ward, one long blow and one short blow, repeated again.
Second ward, one long blow and two short blows, repeated again.
Third ward, one long blow and three short blows, repeated again.
Fourth ward, one long blow and four short blows, repeated again.
Fifth ward, one long blow and five short blows, repeated again.
Sixth ward, one long blow and six short blows, repeated again.
Fuller & Johnson Mn'f'g Co., threee long blows, repeated again.

List of Fire Hydrants.

For the benefit of the fire deparment and Water Works combined, the following table of fire hydrants is arranged and kept up, the new hydrants placed being also added. I trust that in the near future the city will be able to put in an electric fire alarm, which will be a great help to us, and aiding our efficient fire department in the extinguishment of fires. We have added two hydrants the last season.

No.	*Location.*
1	Southwest corner on Dayton and Bruen streets.
2	Southeast corner Charter and Dayton streets.
3	Southwest corner Johnson and Charter streets.
4	Southwest corner Johnson and Brooks streets.
5	Southwest corner University avenue and Park street.
6	Northwest corner State and Park streets.
7	Southwest corner University avenue and Lake street.
8	Southeast corner State and Lake streets.
9	Southwest corner Langdon and Lake streets.
10	Southwest corner Langdon and Francis streets.
11	Southwest corner State and Francis streets.
12	Southeast corner State and Gilman streets.
13	Southeast corner Gorham street and University avenue.
14	Southeast corner State and Gilman streets.
15	Southeast corner Johnson and Broom streets.
16	Southeast corner State and Johnson streets.
17	Southeast corner Gorham and Henry streets.
18	Southeast corner Gilman and Henry streets.
19	Northeast corner Langdon and Henry streets.
20	Northeast corner Langdon and Carroll streets.
21	Southeast corner Johnson and Carroll streets.
22	Northeast corner Wisconsin avenue and Dayton streets.
23	Northeast corner Gorham street and Wisconsin avenue.
24	Northeast corner Gilman street and Wisconsin avenue.
25	Southeast corner Gilman and Pinckney streets.
26	Southeast corner Gorham and Pinckney streets.

27 Northeast corner Johnson and Pinckney streets.
28 Southwest corner Webster and Mifflin streets.
29 Northwest corner Webster and Hamilton streets.
30 Northeast corner Johnson and Butler streets.
31 Northeast corner Gorham and Butler streets.
32 Northeast corner Johnson and Canal streets.
33 Northwest corner opposite pumping station.
34 Southeast corner Gorham and Blair streets.
35 Southeast corner Gorham and Blount streets.
36 Southeast corner Gorham and Livingston streets.
37 North corner Brearly and Gorham streets.
38 Northeast corner Johnson and Few streets.
39 Northeast corner Dayton and Baldwin streets.
40 East corner Dickinson and Mifflin streets.
41 East corner Dickinson and North Washington avenue.
42 Northeast corner East Washington avenue and Canal street.
43 Northeast corner East Washington avenue and Butler street.
44 Southeast corner Main and Webster streets.
45 South corner King and Clymer streets.
46 South corner Wilson and Butler streets.
47 North corner Canal and Main streets.
48 East corner Canal and Wilson streets.
49 South corner Williamson and Blair streets.
50 Southeast corner Williamson and Blount streets.
51 Southeast corner Williamson and Livingston streets.
52 West corner Williamson and Paterson streets.
53 West corner Williamson and Brearly streets.
54 North corner Williamson and Ingersoll streets.
55 Northeast corner Spaight and Ingersoll streets.
56 Southeast corner Spaight and Brearly streets.
57 East corner Paterson and Jenifer streets.
58 Northeast corner Wilson and Pinckney streets.
59 Southeast corner Clymer and Pinckney streets.
60 Northeast corner Monona avenue and Wilson street.
61 Southeast corner Wilson and Clymer streets.
62 Southeast corner Clymer and Carroll streets.
63 East corner Fairchild and Clymer streets.
64 Northeast corner Wilson and Henry streets.
65 Northeast corner Wilson and Broom streets.
66 East corner Bassett and Wilson streets.
67 Southeast corner Main and Chi., Mil. & St. Paul R. R. track.
68 Southeast corner Main and Bedford streets.

69 Northeast corner Main and Bassett streets.
70 Southeast corner Main and Broom streets.
71 Southeast corner Main and Henry streets.
72 Southeast corner West Washington avenue and Henry street.
73 South corner West Washington avenue and Broom street.
74 South corner Mifflin and Henry streets.
75 Southeast corner of Miffln and Henry streets.
76 West corner capitol park.
77 Front of city hall.
78 North corner capitol park.
79 Front of market.
80 East corner capitol park.
81 Front of Pioneer block.
82 South corner capitol park.
83 Front of Episcopal church.
84 Madison Manufacturing Company.
85 Southwest corner Mifflin and Bassett streets.
86 Northwest corner Dayton street, near Catfish.
87 Opposite M. H. Ball foundry.
88 Northeast corner Hancock and Mifflin streets.
89 Northeast corner Blair street and East Washington avenue.
90 Northeast corner Langdon and Park streets.
91 Southeast corner Main and Monona streets.
92 West corner University avenue and Warren street.
93 Northwest corner Spaight and Few streets.
94 Northwest corner Rutledge and Baldwin streets.
95 Northeast corner Pinckney and Dayton streets.
96 Southeast corner of Dayton and State streets.
97 Southeast corner Butler and Mifflin streets.
98 Northeast corner Johnson and Blair streets.
99 Northeast corner Johnson and Blount streets.
100 Northeast corner Johnson and Livingston streets.
101 Northeast corner Johnson and Paterson streets.
102 Northeast corner Johnson and Brearly streets.
103 East corner University avenue and Brooks street.
104 East corner University avenue and Mills street.
105 East corner University avenue and Charter street.
106 East corner University avenue and Bruen street.
107 Between Science Hall and Machine Shop, University grounds.
108 Southwest corner Washington avenue and Bassett street.
109 Northeast corner Baldwin street and East Washington avenue.
110 Northwest corner Baldwin and Main streets.

111 Southeast corner Baldwin and Williamson streets.
112 Northwest corner Baldwin and Jenifer streets.
113 East corner Francis street and University avenue.
114 South corner Francis and Dayton streets.
115 North corner of Dayton and Murray streets.
116 South corner Murray and Johnson streets.
117 Greenbush addition, corner Washington avenue and Park street
118 Southwest corner Williamson and Few streets.
119 Southeast corner Mills and Dayton streets.
120 Southeast corner Mills and Mound streets.
121 Southeast corner Mills and Washington avenue.
122 Northwest corner Clymer and Bassett streets.
123 Northwest corner Dayton and Henry streets.
124 Northwest corner Hancock and Main streets.
125 Southwest corner Jenifer and Ingersoll streets.
126 Northwest corner Paterson and Gorham streets.
127 Northwest corner Johnson and Baldwin streets.
128 Opposite Dow's mill.
129 Northwest corner Julia and State streets.
130 At Gas works.
131 Northeast corner Lake and Johnson streets.
132 Northeast corner East Wnshington avenue and Blount street.
133 Northeast corner Blount and Mifflin streets.
134 Southeast corner West Washington avenue and Bedford street
135 Southeast between Monona street and Junction.
136 At West Madison, front of Railroad Hotel.
137 Southeast corner Few and Mifflin streets.
138 Northwest corner Mary and State streets.
139 Northeast corner Dickinson and Williamson streets.
140 Rear of Fuller & Johnson works, near Mifflin street.

LIST OF VALVES.

1 Johnson street off from Bruen street, east.
2 University avenue off from Park street, east.
3 Park street off from University avenue, north.
4 Park street off from State street, north.
5 Lake street off from University avenue, north.
6 Lake street off from State street, north.
7 Lake street off from Langdon street, north.
8 Langdon street off from Francis street, east.
9 Langdon street off from Wisconsin avenue, southwest.
10 State street off from Lake street, east.
11 State street off from Gorham street, east.

12 State street off from intersection of Carroll and Mifflin streets.
13 Gilman street off from State street, east.
14 Gorham street off from State street, west.
15 Gorham street off from State street, east.
16 Johnson street off from State street, west.
17 Johnson street off from State street, east.
18 Gilman street off from Wisconsin avenue, northeast.
19 Gilman street off from Wisconsin avenue, southwest.
20 Gorham street off from Carroll street, northeast.
21 Gorham street off from Wisconsin avenue, northeast.
22 Gorham street off from Wisconsin avenue, sonthwest.
23 Wisconsin avenue off from Gorham street, southeast.
24 Wisconsin avenue off from Gorham street, northwest.
25 Butler street off from Gorham street, northwest.
26 Gorham street off from Blair street, northeast.
27 Livingston street off from Johnson street, northeast.
28 Brearly street off from Johnson street, northeast.
29 Johnson street off from State street, southwest.
30 Johnson street off from State street, northeast.
31 Johnson street off from Wisconsin avenue, southwest.
32 Johnson street off Wisconsin avenue, northeast.
33 Johnson street off from intersection Butler and Hamilton, s. w.
34 Dayton street off from Wisconsin avenue, northeast.
35 Mifflin street off from intersection of Carroll and State, s. w.
36 Mifflin street off from Carroll and State streets, northeast.
37 Wisconsin avenue off from Mifflin and State streets, northeast.
38 Mifflin street off from Pinckney street, southwest.
39 Mifflin street off from Webster street, northeast.
40 Webster street off from Hamilton street, east.
41 Pinckney street off from Mifflin street, northwest.
42 Pinckney street off from Mifflin street, northeast.
43 E. Washington avenue off from Pinckney street, northeast.
44 Pinckney street off from Main street, northeast.
45 Pinckney street off from Main and King streets, south.
46 Pinckney street off from Wilson street, southeast.
47 Main street off from Pinckney and King streets, north.
48 King street off from Main street, east.
49 King street off from intersection of Butler and W. Wilson streets, east.
50 Canal street off from Johnson street, northeast.
51 Canal street off from E. Washington avenue, southwest.
52 Mifflin street off from Canal street, northeast.
53 Main street off from Canal street, northeast.
54 Main street off from Canal street, southwest.
55 Main street off from intersection of Pinckney and King sts., n.
56 Clymer street off from King street, north.

57 Wilson street off from King street, south.
58 Canal street off from Wilson street, northeast.
59 Blair street off from Main street, northeast.
60 Blair street off from Williamson street, north.
61 Williamson street off from Blair street, southwest.
62 Williamson street off from intersection of Jenifer street, n. e.
63 Williamson street off from Paterson street, northeast.
64 Paterson street off from Williamson street, southeast.
65 Williamson street off from Ingersoll street, northeast.
66 Ingersoll street off from Williamson street, southeast.
67 Spaight street off from Ingersoll street, northeast.
68 Jenifer street off from Paterson street, southwest.
69 Wilson street off from Monona avenue, northeast.
70 Wilson street off from Monona avenue, southwest.
71 Monona avenue off from Main street, southeast.
72 Main street off from Pinckney street, southwest.
73 Main street off from Carroll street, northeast.
74 Main street off from Carroll street, southwest.
75 Carroll street off from Main street, southeast.
76 W. Washington avenue off from Carroll street, southwest.
77 Carroll street off from Mifflin street southeast.
78 Broom street off from Mifflin street, northeast.
79 Mifflin street off from Broom street, southwest.
80 W. Washington avenue off from Broom street, southwest.
81 Henry street off from Mifflin street, southeast.
82 Henry street off from Main street, southeast.
83 Henry street off from Wilson street, southeast.
84 Clymer street off from Bassett street, northeast.
85 Bassett street off from Main street, southeast.
86 Main street off from Bassett street, southwest.
87 Main street off from railroad track, near St. P. R. R., N. E.
88 Pumping Station grounds off from Johnson street, 16-inch.
89 Pumping Station grounds off from Gorham street. 10-inch.
90 Fuller & Johnson Manufacturing Co.'s buildings, 4-inch.
91 Broom street of from Main street, southeast.
92 Pinckney street off from Johhson street northeast.
93 Henry street off from Gorham street, northeast.
94 Wilson street off from Bassett street, southwest.
95 Butler street off from Hamilton street, northeast.
96 Mifflin street off from Canal street, southwest.
97 Blair street off from East Washington avenue, southeast.
98 Blair street off from Johnson street, southeast.
99 Johnson street off from Canal street, southwest.
100 Johnson street off from Livingston street, southwest.
101 Johnson street off from Livingston street, northwest.
102 Johnson street off from Brearly street, southwest.

103 Carroll street off from Johnson street, northeast.
104 Dayton street of from State street, southwest.
105 Fairchild street off from Mifflin street, southeast.
106 Butler street off from Wilson street, northeast.
107 University avenue off from Park street, west.
108 Warren street off from University avenue, north.
109 Clymer street off from Monona avenue, northwest.
110 Clymer street off from Monona avenue, southwest.
111 Blair street off from Johnson street, northwest.
112 Webster street off from King street, north.
113 Bassett street off from W. Washington avenue, northwest.
114 Brooks street off from University avenne, south.
115 Mills street off from University avenue, south.
116 Dickinson street off from E. Washington avenue, northwest.
117 Baldwin street off from E. Washington avenue, northwest.
118 Baldwin street off from Williamson street, northwest.
119 Williamson street off from Baldwin street, southeast.
120 Baldwin street off from Rutledge street, northwest.
121 Spaight street off from Baldwin street, southeast.
122 Jenifer street off from Brearly street, northeast.
123 Bedford street off from Main street, southeast.
124 N. Broom street off from Mifflin street, northwest.
125 N. Broom street off from Gorham street, southeast.
126 S. Broom street off from Main street, southeast.
127 Francis street off from University avenue, south.
128 Dayton street off from Francis street, west.
129 Murray street off from Dayton street, north.
130 Johnson street off from Park street, east.
131 Langdon street off from Lake street, west.
132 Pinckney street off from Johnson street, northwest.
133 Greenbush addition Main street, east side of bridge.
134 Greenbush addition intersection Main street, W. Wash. ave.
135 Greenbush addition Park street off from W. Wash. ave., south.
136 Dayton street off from Baldwin street, northeast.
137 Henry street off from Gilman street, southeast.
138 Mills street off from Johnson, street, north.
139 Mills street off from W. Washington avenue, south.
140 W. Washington avenue off from Park street, east.
141 Clymer street off from Bassett street, northeast.
142 Henry street off from Mifflin street, northwest.
143 Dayton street off from Broom street, southwest.
144 Carroll street off from Johnson street, northeast.
145 Hancock street off from Main street, northwest.
146 Jenifer street off from Ingersoll street, southwest.
147 Jenifer street off from Baldwin street, northeast.
148 W. Washington avenue off from Bassett street southwest.

149 Blount street off from Main street northwest.
150 Blount street off from Johnson street, southeast.
151 Few street off from Dayton street, southeast.
152 Mifflin street off from Baldwin street, southwest.
153 Dayton street off from Wisconsin avenue, northwest.
154 Mary street off from University avenue east.
155 Carroll street off from Wilson street, southeast.
156 Gilman street off from State street, west.
157 Gilman street off from University avenue, east.
158 Henry street off from Gilman street, southeast.
159 Fairchild street off from W. Washington avenue, northwest.
160 Broom street off from Wilson street, southeast.
161 Hancock street off from Mifflin street, northwest.
162 Hancock street off from Johnson street, southeast.
163 Hancock street off from Gorham street, southeast.
164 Paterson street off from Gorham street, southeast.
165 Williamson street off from Baldwin street, northeast.
166 Dickinson street off from Williamson street, southeast.

INVENTORY.

October 1st, 1892.

OFFICE.

One office desk, 1 office desk with pigeon holes, 1 large table, 1 small table, 1 revolving chair, 6 office chairs, 1 draughting table, 1 map showing pipe line.

AT STORE ROOM.

Two complete Mueller tapping machines, 5 $\frac{1}{2}$-inch round way stops, 3 1-inch corporation cocks, 19 $\frac{5}{8}$-inch round way stops, 20 $\frac{5}{8}$-inch corporation cocks, 15 $\frac{3}{4}$-inch corporation cocks, 6 $\frac{1}{2}$-inch corporation cocks, 1 1-inch cock and waste, 3 2-inch round way stops, 24 services box covers, 2 $\frac{3}{4}$-inch round way stops, 9 valve boxes, 2 valve keys, 5 $\frac{1}{2}$-inch round way stops, 2 service boxes, 1 Trench pump, 25 pigs of lead.

AT PUMPING STATION.

One large Fairbanks wagon sale, 1 small Fairbanks coal scale, 1 oil stand with 6 oilers, 1 clock, 1 telelephone, 1 extension bell, 6 cuspidores, 1 table, 2 chairs, 1 tool bench, 1 machinist vice, 6-inch jaws, 1 pipe vice No. 2, tool closet, 1 two-foot steel square, 1 stock $\frac{1}{8}$ to $\frac{1}{3}$-inch, 2 pipe cutter No. 2, 1 ratchet, 1 brace, 3 files, 1 stock $\frac{3}{4}$ to $1\frac{1}{2}$-inch, 1 auger bit $\frac{3}{4}$, 3 drills $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$ taps and reamers, 1 stock $1\frac{1}{2}$ to 2-inch, 3 monkey wrenches, 1 punch, 3 pipe tongs No. 1, 2, 3, 2 scale picks, 5 cold chisels, 6 calking tool wrenches, 1 $5\frac{1}{2}$ crowbar, 1 18-inch pry bar, 1 hammer, 1 wooden barrow, 4 ladders, 2 scoops, 3 lanters, 3 oil cans $\frac{1}{2}$ and 1 gallon, 1 iron barrow, 3 water pails, 1 sickle, 1 scythe, 1 breast drill, 1 waste valve 5-inch, 1 lawn mower, 1 truck, 2 rakes, 4 hydrant valves, 2 tripods, 1 tackle, 5 drip vales and rods 4-inch, 1 5-inch waste gate, 6 drip valves and rods 5-inch, 1 5-inch hydrant valve, No. 1 Stillson pipe wrench, 3 4-inch hydrant valves, No. 2 Trimo pipe wrench, 150 feet 1-inch iron pipe, 2

blacksmith tongs, 2 hand tamps, 1 grindstone, 1 axe, 1 force pump, 4 fountain sprays, 9 rubber gaskets 6x9, 10 rubber gaskets 9x14, 5 pounds $\frac{5}{8}$ round rope packing, 1 pound of hemp, 8 glass tubes, 4 pounds square pump plunger packing, 8 yards rubber sheeting, 2 yards Blumbago sheeting, 1 pound asbestos rope packing, 20 pump valves, 1 hoe, 1 5-inch hydrant cover, 5 4-inch hydrant sockets, 1 3-inch Vanduzen pump, 2 oil tanks, 1 pressure chamber, 1 tag mould, 2 coils of $\frac{3}{4}$-inch lead pipe, 6 extension valve boxes, 1 meter test tank, 2 jackscrews, 27 pump springs, 4 $\frac{5}{8}$-inch Hersey meters, 3 $\frac{3}{4}$-inch Hersey meters, 2 $\frac{5}{8}$-inch Crown meters, 2 $\frac{5}{8}$-inch Union meters, 2 $\frac{3}{4}$-inch Union meters, 3 $\frac{5}{8}$-inch Nash meters, 1 $\frac{3}{4}$-inch Nash meter, 1 1-inch Nash meter, 9 meter boxes, 50 feet rubber hose, 150 feet cotton hose and nozzle, 4 $\frac{3}{4}$-inch covers for Crown meters, 4 $\frac{5}{8}$-inch covers for Crown meters, 7 $\frac{3}{4}$-inch Hersey bottoms, 4 $\frac{5}{8}$-inch Hersey bottoms.

FITTINGS.

One $1\frac{1}{2}$-inch tee, 2 $1\frac{1}{2}$-inch elbows, 1 1-inch check valve, 3 1 $1\frac{1}{4}$-inch check valve, $1\frac{1}{2}$-inch brass union, 1 $1\frac{1}{4}$-inch brass unions, 3 2-inch nipples, 1 $1\frac{1}{2}$x$\frac{3}{4}$ tee, 1 2x1 tee, 1 $2\frac{1}{2}$x2 bushing, 2 2x$1\frac{1}{2}$ bushing, 1 2x$1\frac{1}{2}$ bushing.

TOOL BOX.

One crow bar, 1 shovel, 1 spade, 2 picks, 10 tampers, 1 marking rope, 1 rope tackle, 1 metallic tape line, 1 hammer, 2 hemp tools, 1 hardy, 3 diamond chisels, 2 round nose chisels, 3 cold chisels, 4 calking tools, 1 cape chisel, 3 pails, 1 kerosene can, 1 hydrant packing wrench, 1 drill chisel, 1 sledge, 2 chisel bars, 1 tackle, 1 stamp tool, 2 lanterns, 1 2-ton differential block, 1 hand-power drill.

AT PIPE YARD.

One lead kettle and furnace, 12 feet 16-inch cast iron pipe, 29 feet of 12-inch cast iron pipe, 18 feet 10-inch cast iron pipe, 54 feet of 8-inch cast iron pipe, 122 feet of 6-inch cast iron pipe, 850 feet of 4-inch cast iron pipe, 24 feet of 3-inch cast iron pipe, 60 feet of 2-inch cast iron pipe, $7\frac{1}{2}$ feet 8-inch standard cast iron

pipe, 4 feet 6-inch standard cast iron pipe, 17 feet 10-inch well tubing, 16 feet 9-inch well tubing, 3 feet 8-inch well tubing, 164 feet 7-inch well tubing, 1 8x4 tee, 1 16-inch sleeve, 2 14-inch sleeves, 6 4-inch sleeves, 3 3-inch sleeves, 1 4x8 reducer, 1 4x3 reducer, 4 6-inch offsets, 3 4-inch hydrants, 1 5-inch hydrant, 1 8x4 tee, 6 4x4 tees, 1 4x4x3 tee, 2 4x4 crosses, 1 4-inch elbow 45-degree, 1 16x4 cross, 4 4-inch curves.

Laws Relating to Water Works.

EXTRACTS FROM THE CITY CHARTER, ADOPTED, 1882.

SECTION 8. Any person who shall wilfully or maliciously injure or destroy any portion of the works, fixtures or other property belonging or appertaining to said water works, or who shall willfully pullute or otherwise injure any water supplied by said water works, or who shall wrongfully interfere with, or open any hydrants or waste any water therefrom, shall be deemed guilty of a misdemeanor, and, upon conviction thereof, shall be punished by a fine not exceeding one hundred dollars, or imprisonment in the county jail not exceeding six months, or by both such fine and imprisonment, in the discretion of the court.

SECTION 9. It shall be the duty of the common council, and it is hereby empowered, from time to time, to pass such ordinances as may be deemed necessary or expedient for the management and protection of said Water Works, and regulating and controlling the supply and use of water therefrom ; and the council is hereby empowered, when it shall deem it for the best interests of the city, to appoint a board of three water commissioners, to take the entire charge and management of said Water Works, to appoint a superintendent and other employees, to fix their compensation, and to supervise and control the supply and distribution of water throughout the city, and generally to discharge the duties imposed upon the common council by this chapter, under the general control and supervision of said council ; but such commissioners shall receive no compensation for their services.

An Ordinance.

CONCERNING THE WATER WORKS OF THE CITY OF MADISON AND ESTABLISHING WATER RATES, RULES, REGULATIONS, AND PENALTIES, FOR THE GOVERNMENT OF WATER CONSUMERS, LICENSED PLUMBERS, AND OTHERS.*

The Common Council of the City of Madison ordains as follows:

1. That the rules, regulations and water rates hereinafter named shall be considered a part of the contract w[illegible] every person, company or corporation who are supplied with water through the water system of the city; and every such person, company or corporation, by taking water, shall be considered to express his or their assent to be bound thereby; and whenever any of them is violated, or such others as the board of water commissioners may hereafter adopt, the water shall be cut off from the building or place of such violation, although two or more parties may receive water through the same pipe, and shall not be let on again except by order of the superintendent, and on payment of the expenses of shutting it off and turning it on, and such other terms as the board of water commissioners shall determine, and a satisfactory understanding with the party or parties that no further cause of complaint shall arise; and in case of such violation, the superintendent shall have the right to declare any payment made for the water by the person committing such violation, to be forfeited, and the same shall thereupon be forfeited.

SECTION 2. There shall be appointed by the board of water commissioners one man who shall be general executive officer or superintendent of the water works, who shall give bond in the sum of two thousand dollars, conditioned for the faithful discharge of his duties.

*The Board of Water Commissioners is substituted for common council throughout this ordinance. See ordinance, March 3, 1884.

SECTION 3. It shall be the duty of said superintendent to see that the by-laws and resolutions of the board of water commissioners are executed; that the conditions of all contracts by or with said works are faithfully complied with; that the assessments of the water rents are duly made, collected, and paid into the city treasury; to credit all accounts and claims, and submit the same to the board of water commissioners, with such explanation as to enable them to act advisedly thereon, and to have a general supervision over all the operations and interests of said works, and shall make a monthly and an annual report of the condition and operation of said Water Works; and shall perform such other duties as the board of water commissioners may prescribe.

SECTION 4. Said superintendent shall also have special supervision of buildings, machinery, grounds and everything connected therewith; shall see that no depredations or misdemeanors are committed; and shall receive such salary as the board of water commissioners shall direct.

SECTION 5. There shall be appointed by the superintendent, subject to the approval of the board of water commissioners, three engineers and fireman of the Water Works.

SECTION 6. Each engineer, during his hours of duty, shall have charge of the engines, pumps, boilers and machine shop, and it shall be his duty, under the direction of the superintendent, to have the care and supervision of the operation of the machine shop, the running of the engines and other machinery connected therewith, and perform such other duties as the board of water commissioners may prescribe. The salaries of chief engineer, assistant engineer and fireman shall be fixed by the board, and the hours of service shall be as directed by the superintendent.

SECTION 7. Any plumber wishing to do business in connection with the Madison City Water Works, before entering into an agreement to do so, must procure a license, and furnish the board of water commissioners satisfactory evidence that he is a regularly educated plumber, that he is a master of his trade, and

willing to be governed in all respects by the by-laws, rules and regulations which are or may be adopted by the common council or board of water commissioners. The amount to be paid for such license shall be $5.00. Said plumber shall also be responsible for all damages the Water Works may sustain at his hands ; he shall also enter into bonds in the sum of one thousand dollars, with two good and sufficient sureties, subject to the approval of the board of water commissioners, to indemnify and save harmless the city of Madison of and from all accidents, damages and losses which said Water Works may sustain by reason of his failure to comply with all rules and regulations, which are now or may hereafter be established by the common council or board of water commissioners.

Section 8. Plumbers shall make full and complete returns to the superintendent of the uses for and to which water is applied under any permit granted. Said returns must be made by the plumber doing the work within forty-eight hours after the completion of said work, and must contain a complete list of all articles and fixtures used, as the water will not be turned on any premises until after said return is made, and the work reported to be in accordance with the rules and regulations herein prescribed.

Section 9. Plumbers in making returns of permits shall give name of street or lot line in which the attachment has been made, and whether the service pipe enters the premises on the north, south, east or west side of said street; and also state accurately the distance of the stop-cock box from the near side line of the nearest cross-street, lane or alley, or other well defined public place. The measurements to be recorded in feet and tenths and twelfths of a foot, and made in a direction parallel with the side line of the named street to where said line intersects the near side line of the nearest cross street, lane or alley. In cases where the alignment of any street, lane or alley is not well defined, the measurement must be continued until a well defined street line is reached, which must be intelligently described in the return.

Section 10. No plumber, pipe-fitter or other person, shall make any attachment to any old pipe or water fixtures in premises from which the water has been shut off and the supply discontinued, without the party desiring such work to be done, having first made application and obtained a re-issue and permit for the same. Nor shall any plumber, pipe-fitter or other person make any alteration in any pipe or water fixture attached to the Water Works distributing pipes, to conduct water into adjoining premises, or into stables, baths, water closets, wash basins, cisterns, fountains, or for any other purposes whatever, without application having first been made, and a written permit obtained from the superintendent for each and every separate job of such modifications in the water fixtures, and in no case shall any plumber, after the completion and trial of any job of plumbing work, be it the first introduction of service pipe, an extension, or a repair, leave the water turned on on the premises, but shall in all cases close the stop-cock on the sidewalk, and return his permit.

Section 11. No service connection or other attachments to any of the water mains shall be made except by brass ferule or lead pipe up to one inch in diameter, and when iron pipe is used the attachments must be made by a heavy nipple screwed into the water main, and in no case will lead or iron pipe be allowed between the water main or stop-cock weighing less per foot than as follows :

Lead pipe, ⅜ inch, Medium, 1 ℔. per foot.
Lead pipe, ½ inch, Strong, 1 ℔. 12 oz. per foot.
Lead pipe, ⅝ inch, Strong, 2 ℔s. 8 oz. per foot.
Lead pipe, ¾ inch, Strong, 3 ℔s. per foot.
Lead pipe, 1 inch, Extra Strong, 4 ℔s. 12 oz. per foot.
Lead pipe, 1¼ inch, Extra Strong, 6 ℔s. per foot.
Lead pipe, 1½ inch, Extra Strong, 7 ℔s. 8 oz. per foot.
Lead pipe, 2 inch, Extra Strong, 9 ℔s. per foot.

Iron pipe must be made of quality known as extra strong lap welded, and must be coated both inside and outside with Dr. Smith's preparation, applied when both are heated to a temperature of 300° F.

No galvanized pipe will be allowed.

No pipe other than the above will be allowed, nor will any party using pipe other than the foregoing be allowed to connect with the Water Works.

SECTION 12. Any plumber or pipe-fitter who shall be guilty of a violation of any of the by-laws, rules and regulations adopted by the common council shall forfeit his license. Such forfeiture shall operate as a suspension of the license held by any co-partner in the same business or any person in his employ.

SECTION 13. All water rents shall be paid semi-annually, the first day of January and July of each year in advance; if not complied with, within three days, ten per cent. penalty will be added, and if not paid in six days the water will be shut off. Meter rates shall be paid monthly; ten per cent. penalty will be added if the rent is not paid in ten days after the same becomes payable.

SECTION 14. Persons wishing water must get a special permit from the superintendent, for each building, residence, business, etc. The superintendent or the person authorized by him, shall in all cases tap the water main and put in the service pipe to a point in line with the fire hydrant, or the inner side of the curbstone where there shall be a corporation cock and stop-box. For each original permit or tap a charge of $2.00 will be made.

SECTION 15. No person, except the superintendent or the chief engineer of the fire department, shall take water from any public or private fire hydrant, fire plug, street washer, draw cock, hose pipe or fountain (except for fire purposes, or for the use of the fire department in case of fire), nor shall in any way use or take any water for private use which is furnished by the Water Works, unless such person shall first pay for the privilege and receive the usual permit from the superintendent so to do.

SECTION 16. The water will not be turned into any house or private service pipe, except where meters are used, until the applicant shall have paid the rent due for the current six months, and shall exhibit his receipt therefor; and plumbers are strictly prohibited from turning the water into any service pipe except

upon the order or permission of the superintendent. This rule shall not be construed to prevent any plumber admitting the water to test pipes, and for that purpose only.

SECTION 17. Every lead service pipe must be laid sufficiently waving to allow of not less than one to one and a half feet extra length, and in such manner as to prevent rupture by settlement. Every service pipe must be provided with a stop and waste cock for each consumer, easily accessible, and so situated that the water can be conveniently shut off and drained from the pipes.

SECTION 18. The superintendent, and such other person as may be directed by the superintendent, shall be authorized to enter and have free access at all reasonable hours to premises, to ascertain the location or condition of all hydrants, pipes or other fixtures attached to said works, and in case he finds that water is wasted on account of negligence or for want of repairs, and if such waste is not immediately remedied, the water leading to such premises shall be turned off. It shall also be the duty of said officer, in case he discovers any defect in a private pipe between the city service pipe and the stop-cock, to give notice in writing to be left at the premises, and *if* necessary repairs are not made within twenty-four hours thereafter, the water shall be stopped and shall not be turned on again until the sum of three dollars has been paid to the treasurer, such money to go to the credit of the Water Works fund.

SECTION 19. Persons taking water must keep their service pipe and all fixtures connected therewith in good repair and protected from frost at their own expense, and must prevent all unnecessary waste, or the water will be shut off.

SECTION 20. In sprinkling lawns, washing windows, etc., as per section 25, each water taker must confine himself to his own frontage, or square feet for which he pays water rent as per tariff of water rates. In case he sprinkles, or permits to be sprinkled, more than the above frontage, he shall be charged for the whole at the same rate per lot.

Section 21. Any consumer or consumers of water who shall permit others not members of his or their family or families to use water from his or their hydrants, faucets or other device without knowing that the proper water rent has been paid, and any one who shall thus obtain water without a permit from the superintendent, shall be fined in a sum of not less than one nor more than ten dollars, and the water shut off.

Section 22. Hydrants hose attachments, faucets, or any other device which the consumer may adopt for obtaining water from the service pipes, shall not be located so as to be accessible to persons living in or occupying neighboring premises, or to the public; and the water shall not be turned on such hydrant, faucet or other device until such hydrant is removed to some unexposed place on said premises.

Section 23. Parties desiring water for cisterns, tanks or other intermittent supply will be charged regular rates as per schedule, or furnish at their own expense a water meter, to be approved by the superintendent. Persons intending to build or repair any building, for which the water from the works is to be used, shall make application to the superintendent, giving the certified statement of the architect or builder, of the number of brick, perches of masonry, yards of plastering to be laid, and other uses for the water, and pay the schedule rates therefor. The superintendent shall thereupon grant a permit to use the water for said purposes to the extent of the work returned by the architect or builder. Any abuse of this privilege, or neglect to guard against the use of water for other than that stated in the permit, will subject the owner to have the water turned off, and it will not be turned on again until satisfactory assurances are given that like abuses shall not again occur.

Section 24. Hydrants, taps, hose, water closets, urinals, baths or other fixtures, will not be permitted to be kept running when not in actual use, without special permit and the payment of additional rates; such rates to be determined by the superintendent, who shall report the same to the board of water commissioners.

SECTION 25. The use of the hand hose is permitted at hours in the day named below, during the season, from April 1st to November 1st, for any of the purposes named in the permit, to-wit: Sprinkling lawns and gardens, washing sidewalks, walks, steps, windows and fronts; *except in case of fires, or when there is an alarm of fire.* During such time the use of hand hose is positively prohibited for any of the uses heretofore enumerated; *provided*, that the water for lawn sprinkling purposes, except for water carts, shall only be used between the hours of 5 and 8 o'clock A. M., and after 5 o'clock to 9 o'clock in the evening. Washing windows, etc., from 5 to 9 o'clock A. M. Street sprinkling by hose is prohibited.

SECTION 26. Any person desiring to discontinue the use of Water Works water must give notice thereof in writing to the superintendent, on or before the day to which the rent has been paid, or they will be charged with water rent to the next rent day.

SECTION 27. On streets where mains are laid. service pipes will not be allowed to run across lots, that is, from one lot to another, but must be taken from the mains in front of the premises, or some point in the street adjacent to the same; *provided*, that one service pipe may be used to supply all the parties taking water within thirty feet on either side of such service pipe.

SECTION 28. Service pipes intended to supply two or more distinct premises or tenements, and where only one stop-cock is used, the person or persons controlling the same must pay the water rent of all parties who are thus supplied, as separate water bills will not be made.

SECTION 29. No hose shall be used in any case unless a permit for such has been properly applied for and allowed by the superintendent, and in no case shall it be used without a nozzle, and the nozzle shall not exceed one-fourth of an inch in diameter, unless specially authorized.

SECTION 30. Hose larger than three-quarter inch will not be permitted, except upon payment of an additional charge.

SECTION 31. No claim shall be made against the city of Madison, by reason of the breaking of any pipe or service cock, or for any interruption of the supply, or by any reason of the breaking of machinery, or stoppage for necessary repairs.

SECTION 32. No permit shall be understood to authorize anything not explicitly and truthfully stated in the application, and any misrepresentation in such application the plumber shall report to the superintendent.

SECTION 33. Street washers and stop-cocks shall be placed on the inner side of the curbstone in paved streets, and in the same relative position in unpaved streets.

SECTION 34. No person authorized to open hydrants shall delegate his authority to another or let out, or suffer any person to take the wrenches furnished him, or suffer the same to be taken from any hose house of said city, except for purposes strictly connected with the fire department, or as they accompany hose carts on occasions of fire.

SECTION 35. No person will be allowed to put in hydrants, sprinklers or private plugs without a stop-cock.

SECTION 36. Except where meters are used, no lease of water will be made for a shorter period than six months, or untll the first day of July or January. No rebate will be allowed for partial use of water from wells, cisterns, etc. The parties desiring to use the water in this way may procure and set in an approved meter at their own expense, and thereafter pay for the water used at meter rates. The right is reserved to attach meters to any service pipe whenever the superintendent shall deem it expedient, and thereafter charge for the quantity of water measured instead of the special rates before charged.

SECTION 37. The board of water commissioners shall order laid all necessary pipes to supply water whenever the revenue shall be ten dollars for every sixty-six feet of pipe laid, or there shall be an equivalent of two customers who will take water for every one hundred and thirty-two feet of pipe so laid.

SECTION 38. Connection with the service pipe must be laid at least five feet deep.

SECTION 39. After service pipes are laid, in refilling the opening, the earth must be laid in layers of not more than nine inches in depth, and each layer thoroughly tamped or puddled to prevent settlement, and this work together with the replacing sidewalks, ballast and paving must be done so as to leave the street in as good condition as before it was disturbed, and to the satisfaction of the superintendent. No opening of the street for tapping mains will be allowed when the ground is frozen.

SECTION 40. Yard fountains shall not be used more than six hours per day, and only between April 1st and November 1st, except by special permission and upon payment of additional charges. The service pipe of fountains out of doors must be provided by the persons with stop-cocks under the control of the superintendent. The right is reserved to suspend the use of fountains and hose for sprinkling streets, yards and gardens, whenever in the opinion of the superintendent, the public exigency may require it.

SECTION 41. If proprietors of manufactories, lumber yards, halls, stores, elevators, warehouses, hotels or public buildings, being regular consumers of water from the works, wish to lay large pipes with hydrant and hose couplings to be used only in case of fire, they will be permitted to connect with the street mains at their own expense upon application to the superintendent and under his directions, and will be allowed the use of water for fire puposes only, free of charge ; but all such pipes must be provided with a suitable valve which must be sealed by the superintendent, and a stop and waste-cock attached at the bottom or inside of the building. In case the seal is broken for the extinguishment of fire, the party shall immediately give notice to the superintendent, and in case the seal shall have been broken for any other use, the party so offending shall be fined the sum of twenty-five dollars. No stand pipe will be allowed on the premises where the water is not taken for other than fire purposes.

SECTION 42. There shall be erected a drinking fountain at the high school, and at each ward school, a drinking fountain for

man and beast at the market, and at the corner of University avenue and Park street, corner of Johnson and Livingston streets, corner Williamson and Jenifer streets, and at the corner of Main and Bedford streets, also a fountain in front of the Water Works building.

SECTION 43. After the organization of the third Tuesday of April in each year, the mayor shall appoint five members of the common council, one from each ward, to be confirmed by the common council, who shall constitute the Water Works committee.

SECTION 44. The water commissioners shall have full jurisdiction of said works, and see that the officers comply with their duties and report from time to time to the common council any repairs, additions and improvements they may deem necessary.

SECTION 45. Any plumber or pipe fitter who shall be guilty of a violation of any of the sections in this ordinance, shall be punished on conviction in the municipal court by a fine of not exceeding fifty ($50.00) dollars together with costs.

SECTION 46. The following rates are hereby established for the supply of water to consumers:

WATER RATES.

		Per Annum.
Banks, including one wash basin		$10 00
Bakeries	$8 00 to	10 00
Barber shops, one chair		3 00
Barber shops, each additional chair		2 00
Bath houses, public, per tub		10 00
Bathing tubs in barber shops, each		4 00
Billiard rooms, each table		2 00
Blacksmith shops, one fire		3 50
Blacksmith shops, each additional fire		3 00
Book binderies		8 00
Bottling ale and beer	5 00	10 00
Breweries, distilleries, rectifiers and malt houses, estimated at 160 gallons to the barrel, per 1,000 gallons		15
Building purposes for 1,000 bricks wetting and making mortar		10

Building purposes per 100 square yards of plastering	15
Building purposes, stone per cord	10
Butcher shops 8 00 to	10 00
Bowling alleys	5 00
Candy manufactories 8 00 to	10 00
Cells in jails, each	1 50
Churches free, less the price of service pipe, cocks, etc.	
Cigar mannfactories, per hand	1 50
Cisterns filled (exclusive of labor), 50 bbls. or less, $2.00, each additional 50 bbls. or less, $1.00.	
Club rooms 3 00 to	5 00
Commercial colleges 5 00 to	10 00
Confectionery	10 00
Dental office	5 00
Drug stores	10 00
Dwelling houses, six rooms or less for each family	5 00
Each additional room	50
Dwelling houses or tenements, two or more families, each family	4 00
Dyeing and scouring, including laundries 15 00 to	25 00
Eating houses 10 to	20 00
Fountains flowing not exceeding eight hours per day during the season, from the first day of April to the first day of November, one-eight inch orifice	15 00
Each additional ⅛ inch jet	2 00
Each additional 1-16 inch jet	2 00
Fountains, 1-16 inch jet for season	10 00
Fountains, ¼ jet	25 00
Fountains, 5-16 jet	45 00
Fountain nozzle or revolving sprays	2 50
Fountain butterfly valves	5 00
Glass or tumbler washers	15 00
Gas works, special or meter rates.	
Hose for washing and sprinkling sidewalks, gutters, the outside of buildings. per lineal foot front, business houses for season	10
Same as above, private houses	05
Hose for sprinkling lawns of 2,000 square feet	1 00
Hose, when used as a fountain, fountain rate.	
Hotels per room	1 00
Ice cream saloons, three tables or less	6 00
Each additional table	50

Laundries, meter rates.	
Livery, sale and feed stables, per single stall, including washing carriages	1 25
Locomotives, special or meter rates.	
Lumber yards, meter rates.	
Manufacturing establishments, special or meter rates.	
Offices and sleeping rooms occupied by not more than two persons	3 00
Offices and sleeping rooms, each additional person	1 00
Photograph galleries	10 00
Private stables, one horse, one cow; or two horses, washing carriages	2 00
Private stables, each additional horse	1 00
Private bath tubs	3 00
Private bath tubs, each additional tub	2 00
Printing offices, engines extra 10 00 to	25 00
Public bath tubs, each tub	5 00
Public halls 5 00 to	20 00
Puddling ditches, etc., special rates.	
Restaurants for three tables or less	6 00
Restaurants, for each additional table	50
Railroad depots, special or meter rates.	
Stores, 22 feet or less	5 00
Stores, each additional foot	50
Stores, of irregular shape, in proportion.	
Saloons	15 00
Schools, not boarding, 25 scholars	5 00
Schools, not boarding, each additional scholar	20
Soda fountains	5 00
Soap manufactories, special or meter rates.	
Steam engines, each horse power	2 00
Steam engines, each horse power, per 24 hours	4 00
Steam boilers, for house warming, etc., for each square foot, fire surface	30
Street sprinklers, each cart per week, during season	6 00
Tobacco warehouses	10 00
Urinals, public, with constant flow	6 00
Urinals, in hotels, boarding houses and saloons	3 00
Urinals, in blocks and manufacturing establishments	2 50
Urinals, in stores, banks and offices	1 50
Urinals, private houses	2 00
Warehouses, special or meter rates.	

Wash basins, stationary, first basin in private family, free; all others, each	1 00
Water closets, private, per bowl	2 50
Water closets, public, per bowl	5 00
Water carts, per 100 gallons	05
Water power for sewing machines, private family	3 00
Water power for seamstresses and tailors ......5 00 to	8 00
Water power for other purposes not allowed.	
Workshops, 10 persons	3 00
Workshops, each additional person	25
Yard hydrants, dwelling or boarding house rates.	

All persons not satisfied with the schedule of rates above can have the privilege of putting in a water meter at their own expense.

Rates for all other purposes that may be applied for, not named in the foregoing schedule, will be fixed by estimation or meter, at the option of the superintendent and water works commissioners.

The rates are subject to the provision that any person taking water for any purpose, however small, must pay at least at the rate of $5.00 per annum.

Rules for the Water Meters.

The following rules have been adopted by the board of water commissioners, to govern the use of water meters :

SECTION 1. All services which may hereafter be connected with the city water works system shall be connected with the meter furnished by the city, if such services shall include sewerage, cesspool or sprinkling of streets or lawns. And all other services and connection shall be so placed that meters can be attached whenever the board of water commissioners may direct it to be done. The water rent wherefore such meter shall have been placed shall be according to the measurement of the meter used. All water meters shall be placed inside of buildings. From and after January 1, 1892, water meters will be placed on all premises that now have the service connection where the present rate of water rent equals or exceeds eight dollars ($8) per annum, and in connection with all services used for sprinkling purposes where the water rent for sprinkling purposes shall exceed three dollars ($3) per annum; and also in connection with such other services where it shall be discovered that there is a constant flow of water, or no meter being used, or as the board of water commisssioness may from time to time deem proper and necessary. All new water services hereafter made for domestic purpose only shall be so constructed and placed that meters can be readily attached whenever the board of water commissioners may order the same to be done.

SECTION 2. The City of Madison will furnish all meters for one building free to consumers. All meters must be placed by a licensed plumber at expense of property owners, and as near as possible to where service pipe enters building. The plumber doing the work must flush pipe thoroughly before connecting meter. The city will repair all meters that are clogged, and if lead chips are found to be the cause a fine of $1.00 will be collected from the plumber doing the work for each and every job so found, before issuing another permit to said plumber. No water meter shall be removed or disturbed without first having obtained permission from the superintendent of the Water Works.

SECTION 3. A check and waste shall be placed between the shut-off cock and meter within one foot of the meter. All meters shall be so located and placed as to afford easy access thereto, and so that they can be easily examined and read. In all cases where meters have been ordered and have been supplied, no water from the city Water Works shall be taken, received or supplied to the building for which the same was constructed and intended except that which shall pass through and be registered by such meter.

SECTION 4. The consumers of the water supplied through any water meter shall make all necessary repairs for the proper operation of such water meter, and in case the city of Madison shall deem it necessary and expedient to repair a defective water meter, the expenses of such repair shall be chargeable to such consumers and shall be paid

at the time such repair was made, and in case of failure to pay for such repair, the superintendent of the Water Works shall shut off the flow of water furnished through such meter.

SECTION 5. In case that any water meter should fail to register the quantity of water passing through the same, the consumers will be charged at the rate of the average daily consumption registered by such meter before the same became out of repair.

SECTION 6. In all cases where one service connection or yard hydrant, does supply two or more separate consumers, premises, tenements, business houses or a block occupied by divers parties, one meter only will be placed at the service connection for either or all of said consumers, and the water rent as registered by said meter shall be chargeable to, and payable by the owner of said premises or buildings.

SECTION 7. The rate of water rent to be charged where such meters are in use shall be according to the schedule rate established by ordinances, the minimum whereof being in all cases five dollars ($5) per annum.

SECTION 8. Water rents where meters have been placed, shall be collected for the first six months at the schedule rate. Thereafter as per record of meter the preceding six months in a manner as prescribed in Section 13 of Water Works ordinance. No water meter rental will be charged by the city of Madison.

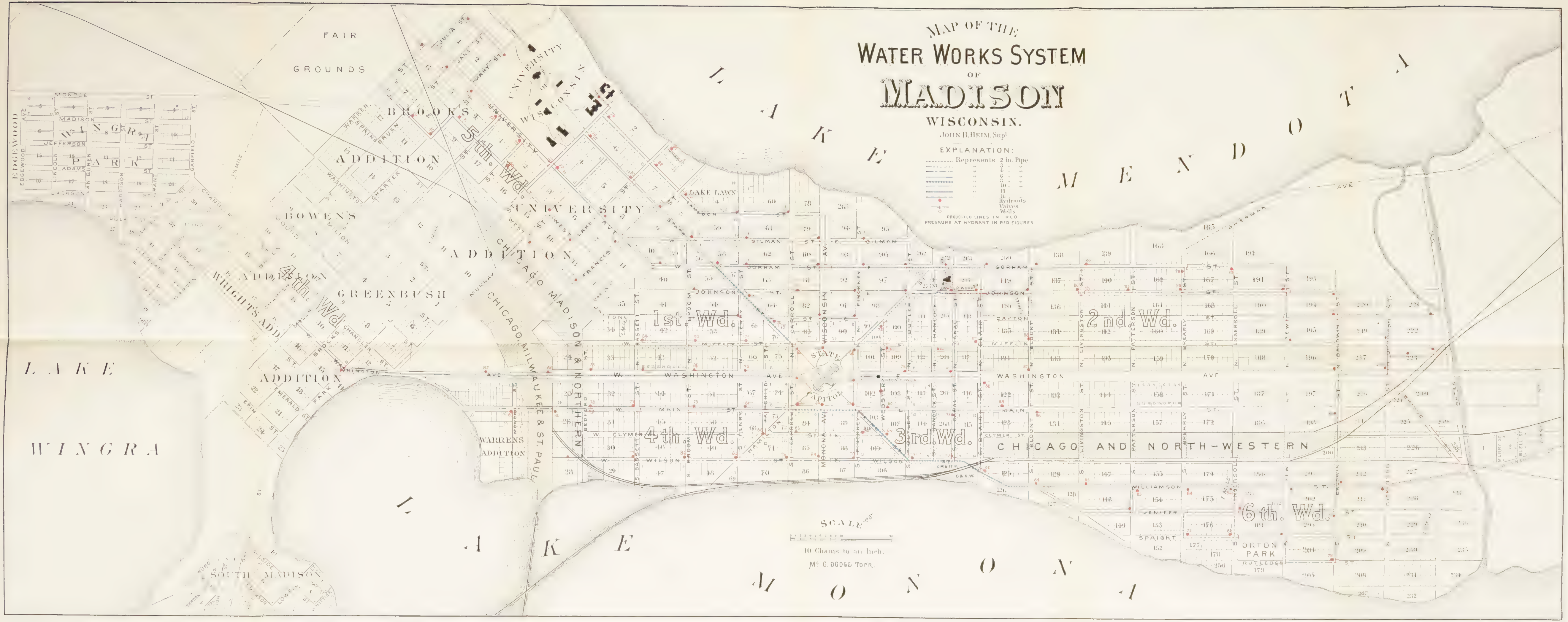
SECTION 9. The superintendent of the Water Works system, or any person employed by the board of water commissioners shall be given free and ready access to the premises and buildings for the purpose of examining or repairing any meter or connection therewith. Any and all meters shall be left in the condition and manner as set by the city, and shall not be interfered with in any manner whatsoever.

SECTION 10. In case of any violation of any of the foregoing rules and regulations, the water supply furnished to the consumer guilty of such violation shall immediately be shut off and shall not be resumed except upon a satisfactory adjustment of all the differences connected therewith, and upon the payment of the sum of one dollar for shutting off and turning on the water. Anybody violating any of these rules and regulations shall upon conviction thereof, be subjected to a fine not to exceed twenty-five dollars ($25), and the cost of prosecution.

METER RATES.

10,000 Cubic feet or less, per six months, per 100 cubic feet				20 cents
Over 10,000 cubic feet and less than 20,000, per six months, per 100 cubic feet				15 cents
Over 20,000 "	"	30,000	"	10 cents
Over 30,000 "	"	60,000	"	6 cents
Over 60,000 cubic feet per six months, per 100 cubie feet				5 cents

Minimum, $5.00 per annum.


MAP OF THE
WATER WORKS SYSTEM
OF
MADISON
WISCONSIN.
JOHN B. HEIM, Supt
EXPLANATION:
Represents 2 in. Pipe
Hydrants
Valves
Wells
PROJECTED LINES IN RED
PRESSURE AT HYDRANT IN RED FIGURES
SCALE
10 Chains to an Inch.
Mc C. DODGE Topr.
LAKE MENDOTA
LAKE MONONA
LAKE WINGRA
FAIR GROUNDS
UNIVERSITY OF WISCONSIN
BROOKS ADDITION
UNIVERSITY ADDITION
BOWEN'S ADDITION
GREENBUSH ADDITION
WRIGHT'S ADD
WARRENS ADDITION
SOUTH MADISON
LAKE LAWN
ORTON PARK
STATE CAPITOL
1st Wd.
2nd Wd.
3rd Wd.
4th Wd.
5th Wd.
6th. Wd.
WASHINGTON AVE
CHICAGO AND NORTH-WESTERN
CHICAGO MILWAUKEE & ST. PAUL
CHICAGO MADISON & NORTHERN

ELEVENTH ANNUAL REPORT

OF THE

CITY WATER WORKS

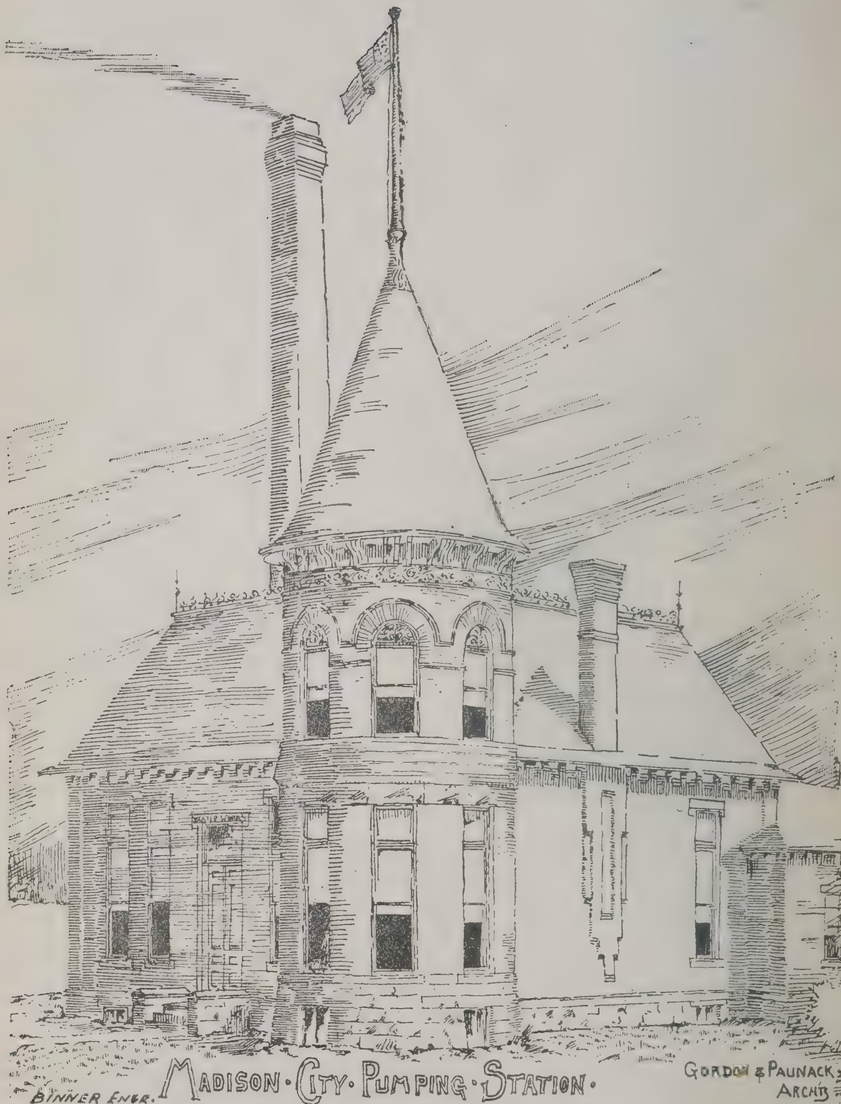
MADISON, WISCONSIN

1893

Compliments of

John B. Heim,

Superintendent.



MADISON · CITY · PUMPING · STATION ·

ELEVENTH ANNUAL REPORT

OF THE

BOARD OF

Water Commissioners

OF THE

CITY OF MADISON.

FOR THE YEAR ENDING SEPTEMBER 30, 1893.

TOGETHER WITH

THE REPORTS OF SUPERINTENDENT AND SECRETARY.

MADISON, WIS.:
DEMOCRAT PRINTING COMPANY,
1894.

OFFICERS OF THE WATER WORKS.

WATER COMMISSIONERS.

JOHN R. MELVIN, President, - -	Term Expires October 1, 1895.
HENRY CHRISTOFFERS, - - -	Term Expires October 1, 1894.
W. W. WARNER, - - - -	Term Expires October 1, 1896.
JOHN CORSCOT, - - - -	Mayor, *ex officio.*
R. F. TAYLOR, - - -	Alderman, *ex officio.*

JOHN F. DONOVAN, Secretary.

SUPERINTENDENT.

JOHN B. HEIM.

METER INSPECTOR.

NICKOLAS REIF.

ENGINEERS.

PETER GAUER,
JOHN KELLY,
DENNIS DACEY.

FIREMEN.

PATRICK DORIS,
WM. D. TENNEY.

ELEVENTH ANNUAL REPORT

OF THE

Department of Water Works.

REPORT OF THE COMMISSIONERS.

OFFICE OF THE
BOARD OF WATER COMMISSIONERS,
MADISON, WIS., February 10, 1894.

To the Honorable, the Mayor and Common Council of the city of Madison, Wisconsin:

GENTLEMEN:—We herewith submit our eleventh annual report of the condition of the Madison City Water Works for the year ending September 30, 1893.

For a statement of the financial transactions of the past year and the present financial condition of the Water Works, we refer you to the report of the Secretary of this Board. The matter of extensions and operating for the past year has been so ably and carefully presented by the Superintendent in his report, which is herewith submitted, that we do not deem it necessary to go over it, but to this report invite your careful attention.

We fully concur in all of the recommendations there made, as we are confident that every suggestion and recommendation offered by the Superintendent has for its object the increased efficiency and success of the Madison City Water Works.

Very respectfully yours,
JOHN R. MELVIN,
HENRY CHRISTOFFERS,
W. W. WARNER,
JOHN CORSCOT,
RICHARD F. TAYLOR,
Commissioners.

SECRETARY'S REPORT.

MADISON, Wis., Feb. 1, 1894.

To the Honorable, the Board of Water Commissioners of the City of Madison, Wisconsin.

GENTLEMEN:—I have the honor of submitting to you herewith, the eleventh annual secretary's report of the receipts and expenditures of the Madison City Water Works for the year ending September, 30, 1893:

RECEIPTS.

Balance on hand October 1, 1892	$6,775 74	
Water rates collected	16,201 70	
Water permits	298 00	
From tax of 1892	5,000 00	
Water bonds sold	10,000 00	
Pipe and supplies sold	38 05	
Meters sold and repaired	51 00	
EXPENDITURES.		
Construction expenses paid		$19,858 88
Operating expenses		10,458 79
Repairs		64 41
Transferred to sinking fund		5,000 00
Balance an hand October 1, 1893		2,982 41
	$38,364 49	$38,364 49

MISCELLANEOUS.

Total receipts from water rates since construction of the works to October 1, 1893	$128,727 77
Total receipts from water permits same period	3,600 00
Total operating expenses from beginning of works to October 1, 1893	93,090 60
Total cost of extension and construction to October 1 1893	271,435 96
Total cost of repairs to October 1, 1893	2,185 58
The bonds issued for the construction of the water works were	76,000 00
Bonds now outstanding of this series	27,000 00
New issue of bonds	10,000 00
Total amount of bonds outstanding	37,000 00
The annual interest on the same at 5 per cent is	1,850 00

Respectfully submitted,

JOHN F. DONOVAN,
Secretary.

SUPERINTENDENT'S REPORT.

MADISON, WIS., February 1, 1894.

To the Honorable the Board of Water Commissioners:

GENTLEMEN:— In compliance with the provisions of the water works ordinance, I herewith present the eleventh annual report showing the condition of the works, extensions and improvements, that have been made during the past year.

IMPROVEMENTS.

The past year has been one of the busiest and most important in the annals of our water works since their construction, in improvements, additions and extensions. We completed the air chamber, added two artesian wells, added a storage and pipe yard, and issued more original and extension permits than has been done since the two first years, 1883 and 1884. The water takers have increased beyond all calculations, with the certitude, that we can safely estimate that two thirds of our citizens will use the city water the coming year.

PUMPING MACHINERY.

Is in splendid condition, as the average monthly record of the past year shows a duty of 42,903,000 foot pounds of water raised one foot high with 100 pounds of net combustible anthracite pea coal, at 47 revolutions. The contract duty was of six-day duration of 50,00,0000 foot pounds of water raised one foot high, with 100 pounds of best net combustible soft coal in a 24 hours' trial at 88 revolutions.

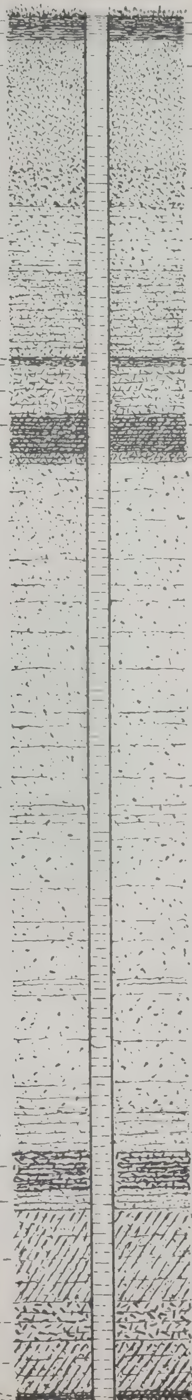
The anthracite pea coal was furnished by N. H. Dodge, at $5.95 per ton, he being the lowest bidder.

NINTH AND TENTH ARTESIAN WELLS.

April 12, 1893, a contract was entered into with O'Connor Bros., of Fond du Lac, Wis., to drill one or more 10-inch wells. Two wells were drilled by the above firm to the utmost satisfaction of your honorable body, and located ninth well corner of Livingston and Mifflin streets, on Livingston street 1,000 feet from eighth well on Blount near Dayton street, and the *tenth* well at the corner of Main and Patterson streets, on Main street 1,000 feet from ninth well. When completed the wells were given a 48 hour test, before connecting; both showed the same quantum of water, which was, at an 18-foot lift, a daily capacity of 599,040 gallons each. The suction pipe was laid to each well to be ready as soon as completed for connection, there was 2,875 feet of 12-inch cast iron pipe, leaded and caulked, laid on a level with suction at station. There are 4,270 feet of suction pipe from pumps to tenth well, a friction loss of two feet lift on account of this distance. The difference of the height of the pumps above wells is nine and one half feet bringing the lift to 14 feet at the best and reducing the daily capacity of each of these two wells to 351,360 or 702,720 gallons per 24 hours. The depth of the ninth well is 821 feet, when we reached the decomposed diabase rock overlying the granite penetrating 81 feet of red and blue calcareous clay after we reached 740 feet, entirely different from all other wells.

The formation of soil and rock penetrated in drilling tenth well is given on next page. From surface to bottom, it is very interesting, and will be the means to preserve the same to posterity. The contractors carefully watched and saved the formations as found on the way down to bottom, to give them correct. We are indebted to C. R. Van Hise, professor of geology in the University of Wisconsin, for the examination and the giving of the geological formations as indexed on sketch of tenth well; sketch was drawn by McClellan Dodge, city surveyor. We also have preserved the formations in a glass tube in the office showing the well in miniature.

Formations Penetrated in Drilling Well No.10.



DEPTH	THICKNESS	DESCRIPTION	
--4,	4 FT.	SANDY LOAM	DRIFT
4--12,	8 "	CALCAREOUS CLAY	
12--40,	28 "	SAND AND FINE GRAVEL	
40-80,	40 "	CALCAREOUS SAND	
80-100,	20 "	SAND AND GRAVEL	
100-135,	35 "	WHITE COARSE GRAINED SANDSTONE	POTSDAM FORMATION
135-180,	45 "	YELLOW SANDSTONE	
180-182,	2 "	GREEN SHALE	
182-185,	3 "	ARENACEOUS LIMESTONE	
185-210,	25 "	CALCAREOUS SANDSTONE	
210-230,	20 "	CALCAREOUS FERRUGINOUS SHALE	
230-235,	5 "	CALCAREOUS SANDSTONE	
235-580,	345 "	SPECKLED WHITE SANDSTONE	
580-600,	20 "	WHITE SANDSTONE	
600-620,	20 "	COARSE GRAINED CALCAREOUS SANDSTONE	
620-630,	10 "	SPECKLED WHITE SANDSTONE	
630-680,	50 "	FERRUGINOUS SANDSTONE	
680-700,	20 "	COARSE GRAINED CALCAREOUS SANDSTONE	
700-728,	28 "	FERRUGINOUS SANDSTONE	
728-730,	2 "	HIGHLY FERRUGINOUS SAND'E	
730-731,	1 "	HIGHLY FERRUGINOUS SHALE	
731-736,	5 "	MUCH DECOMPOSED DIABASE	

The formations of the fourth well were also preserved, but while under examination were destroyed at the fire of the Science Hall. A duplicate of the same being preserved in the water works office, an examination was made of it by E. R. Buckley, assistant to Professor Van Hise. He discovered that some of the formations were misplaced, but thought best to give it as preserved, so as not to be lost entirely, and herewith attach same.

ARTESIAN WELL NO. 4 MADISON CITY WATER WORKS.

No. of feet below surface.	Thickness of bed.		
1–30..........	30 feet.....	Sand and fine gravel,	Drift.
30–40.........	10 feet.....	Calcareous sand.	
40–105	65 feet.....	Calcareous clay.	
105–140.......	35 feet.....	Yellow sandstone,	Potsdam.
140–159.......	19 feet.....	Speckled white sandstone,	
159–160.......	1 foot	Ferruginous sandstone,	
160–179... ...	19 feet.....	Speckled sandstone,	
179–189.......	10 feet.....	Calcareous sandstone,	
189–193... ...	4 feet......	Slightly ferruginous sandstone,	
193–230.......	37 feet.....	Calcareous sandstone,	
*230–468......	*238 feet...	Slightly calcareous sandstone,	
468–478	10 feet.. ..	Ferruginous calcareous sandstone	
478–720.......	242 feet....	Coarse white sandstone,	
720–730... ...	10 feet.....	Fine grained clayey sandstone,	

* The specimen which represents this bed was undoubtedly taken from the upper or lower portion. It is believed that the greater portion is not calcareous.

COST OF NINTH AND TENTH WELLS.

The cost of drilling both wells, includiug the testing, well drum, suction tubing, and connecting same to 12-inch suction, was $5,182.00. The laying of 2,875 feet of 12-inch pipe to both wells through macadam on Johnson St., and balance through marshy soil, fighting water continuously, was $4,549.69.

WATER SUPPLY.

Our water takers are gradually increasing, and with the macadamizing of streets, street sprinkling and the flushing of mains increasing on account of the little water used at

the outskirts, wasting at an average of 140,000 gallons per day, which has to be carried on at least every three weeks for five consecutive days, compelled your honorable body to look for more water, which brought the last two wells and has added to our supply, so that we now have a daily capacity of 1,512,000 gallons of water per 24 hours. The reserve basin at the station when full, contains 198,000 gallons of water. Our greatest consumption as a rule is 1,000,000 gallons per day, which would leave us for fire purposes, taking care of our regular consumption at the same time, 700,000 gallons including basin, and give three first-class one inch fire streams for 6½ hours or 6 first-class one-inch fire streams for three hours with 100 lbs pressure at hydrant. During the past year we pumped 32,210,500 gallons or 88,948 gallons of water per day more than the previous year. Our average daily pumpage was 734,921 gallons or 268,246,300 gallons during the year, and we consumed 353 lbs. of coal more per day during same period.

ADDITIONAL WATER SUPPLY.

Our supply can be increased by adding an additional 12-inch suction pipe from Canal to Blount street. The present suction is between Canal and Blair street, 330 feet of 10-inch pipe, and between Blair and Blount streets, 627 feet of 8-inch pipe, which brings the friction loss to 4 feet. By adding the 12-inch as above it would reduce the loss to 1½ feet, a gain in lift of water of 2½ feet, which means 107 gallons per minute, or 154,080 gallons per day. The above is calculated at 500 gallons per minute at each of the two wells. The cost of this 12-inch suction pipe would be $1,800.00.

Another additional supply would be the *air lift system* which is now undergoing satisfactory experiments and contracted for in different water works well supplies, increasing the capacity of the wells at least 50 per cent. Your honorable body could give this system a personal examination where in use, and if satisfactory it could be attached

to the wells at the pumping station and carried into the reserve basin instead of locating a storage around each well

FLUSHING OF MAINS.

As stated, a continuous flushing of mains is required which greatly adds to the operating expenses and is accomplished under great difficulties, especially in winter and at the outskirts where the flushing has to be done. In the first place there are no gutters, and if so, they are filled with snow; little attention is paid to opening of culverts under crosswalks at these places, hose can not be used during cold weather, and the result is, the water runs all over the street, liable to cause accidents. During the warmer season when hose is used, a general complaint arises in the low places of flooding the lands, which is unavoidable unless gutters or a water way is placed along the property. A great deal of assistance could be given us by the street superintendent in removing obstructions for the passage of the water at all hydrants, especially at the outskirts.

HYDRANTS.

During cold weather we are always examining the hydrants, to be ever ready in case of fire. We find that the hydrants used by the street sprinklers and in low grounds are liable to be caught with a light coating of frost, enough to prevent the hydrant from opening readily. The cause is on account of the soil around the hydrant being saturated with water, through the daily continuous opening during the sprinkling season, and unable to dry out before the frost sets in, and the water surrounding the waste of the hydrants in the low grounds. We of course pay daily attention to these hydrants. This labor also adds to the operating expenses. The using of the hydrants for street sprinkling is a dangerous practice. Our endeavors ought to be to obviate their use for this purpose, as it endangers at all times our fire protection, and sooner or later destroys their efficiency, incurring a large expense. I would

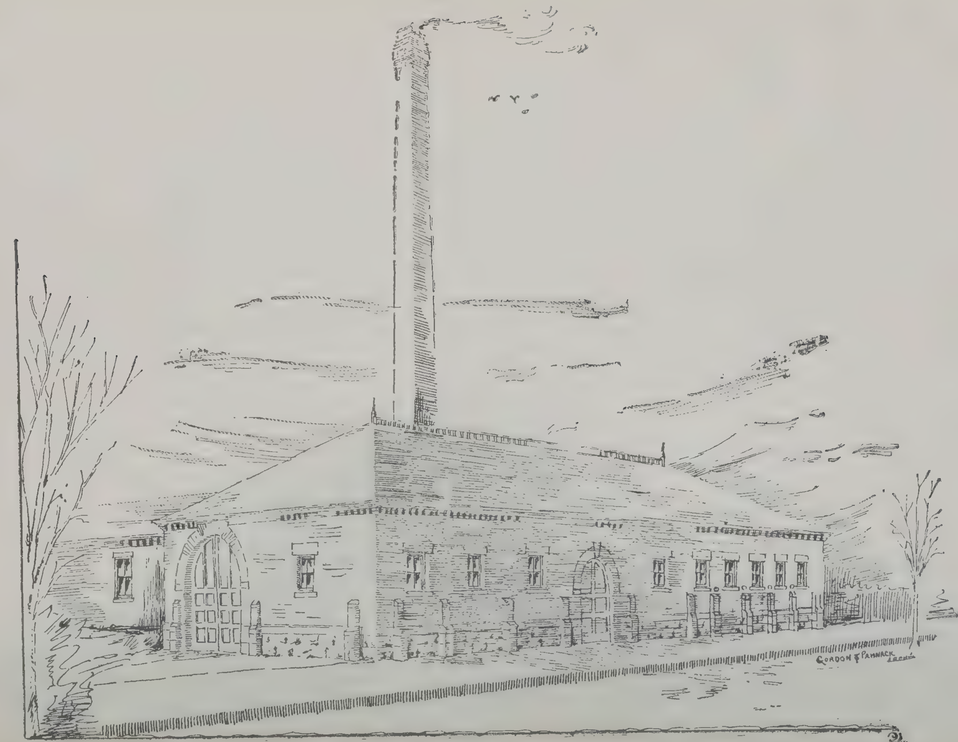
recommend that the street sprinkling be divided into districts, and to place hydrants of easy access, with one nozzle and a special key that cannot be used at the fire hydrants, prohibiting street sprinklers under penalty to use fire hydrants. These same hydrants could also be used in winter for flushing.

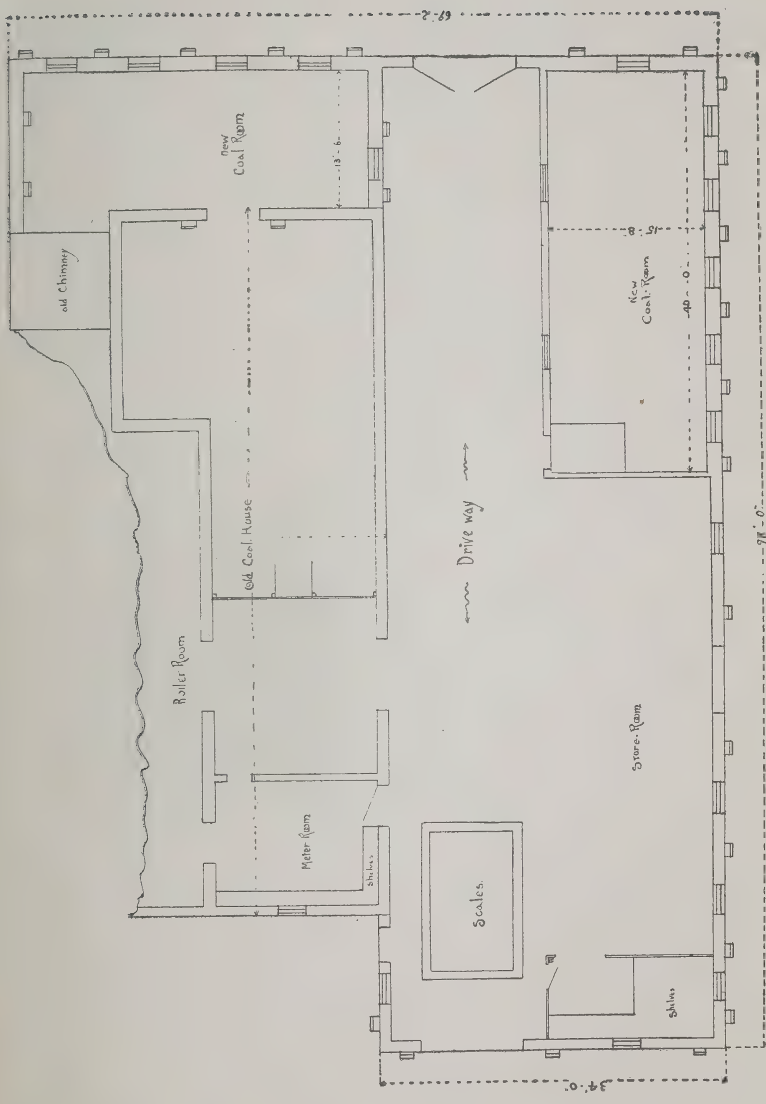
WATER TOWER.

During the year we added an additional overflow connection with the sewer running through the alley between Pickney and Webster streets, from the tank and removed the timber under the tank which had already turned black and begun to decay, replacing it with iron plates at a cost of $342.81.

PIPE AND STORAGE HOUSE.

As recommended in last year's report your honorable body provided a builing at a cost of $3,819.03 in the rear of the pumping station, conforming with the same, to store pipe, specials, hydrants, valves, service and valve boxes, lead pipe, additional coal room, a meter and a hydrant repair room. The main building is 34x98 and the original coal room was enlarged to a capacity of 600 tons of coal. The accompanying sketches show the exterior and interior of the same. The architects were Gordon & Paunack of our city. Sketch was drawn by F. W. Paunack Our pumping plant is now in first class condition and second to none.


GORDON & PANNACK
ARCHTS



69'-2"
New Coal Room
13'-6"
old Chimney
Old Coal House
Drive way
New Coal Room
16'-8"
40'-0"
98'-0"
Boiler Room
Meter Room
shelves
Scales.
Store Room
Shelves
34'-0"

AIR CHAMBER.

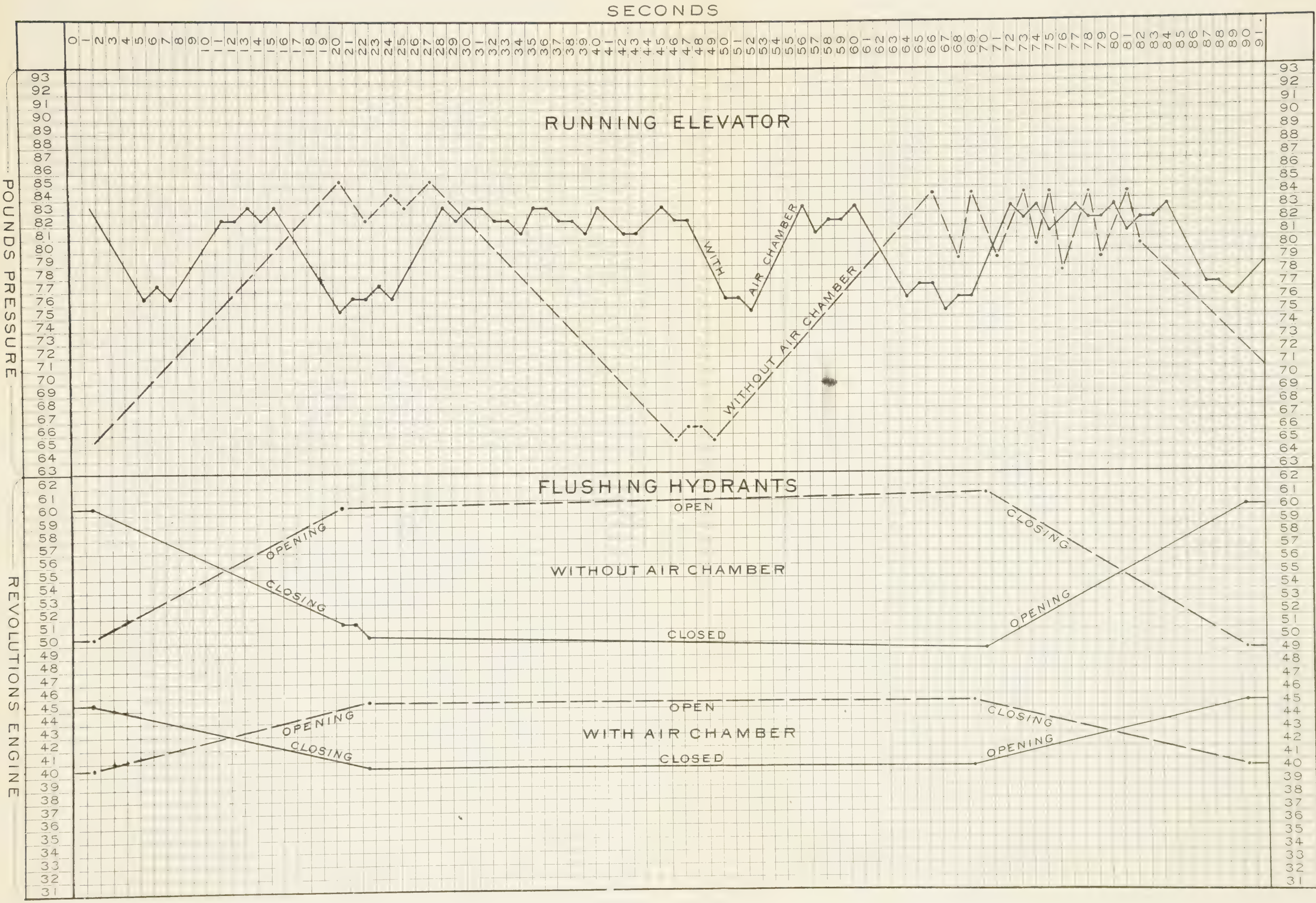
The air chamber in our last report worked to our satisfaction but no test had been made as to the actual workings showing the variation in pressure under all conditions. An hourly test was made and is shown in blue on the annexed diagram including two days' of flushing. The diagram gives the pressure with water tower and without air chamber in black; without tower and air chamber in in red; and with air chamber in blue. The variation in pressure between the red and black is imperceptible, varying from 19 to 85 revolutions, when flushing was done a difference of 66 revolutions, and from 14 to 65 revolutions under ordinary working pressure, a variation of 51 revolutions, whereas the variation with air chamber during flushing is from 38 to 70 revolutions, a difference of only 32 revolutions and under ordinary working pressure from 22 to 58 revolutions, a difference of only 36 revolutions.

EFFECT OF AIR CHAMBER.

This diagram shows the engine speed of 90 seconds under control of air chamber and without, in the sudden opening and closing of hydrants at the pumping station off from 10-inch main, after running at full capacity for three hours. Through the sudden opening of the hydrants with air chambers the engine speed was increased from 40 to 45 revolutions in 20 seconds, the pressure in mains dropped from 71 to 67 pounds and increased to 72 pounds again in 25 seconds. The sudden closing of hydrant increased the pressure from 71 to 75 pounds and the decrease of speed was from 45 to 40 revolutions. Without the air chamber the engine speed was increased from 50 to 60 revolutions, the pressure in mains dropped from 83 to 63 pounds in from 8 to 10 seconds. By the sudden closing of hydrant the engine speed dropped from 61 to 49 revolutions, the pressure in mains increased in proportion. (The engine is not under control of the governor, but at the mercy of the pressure.)

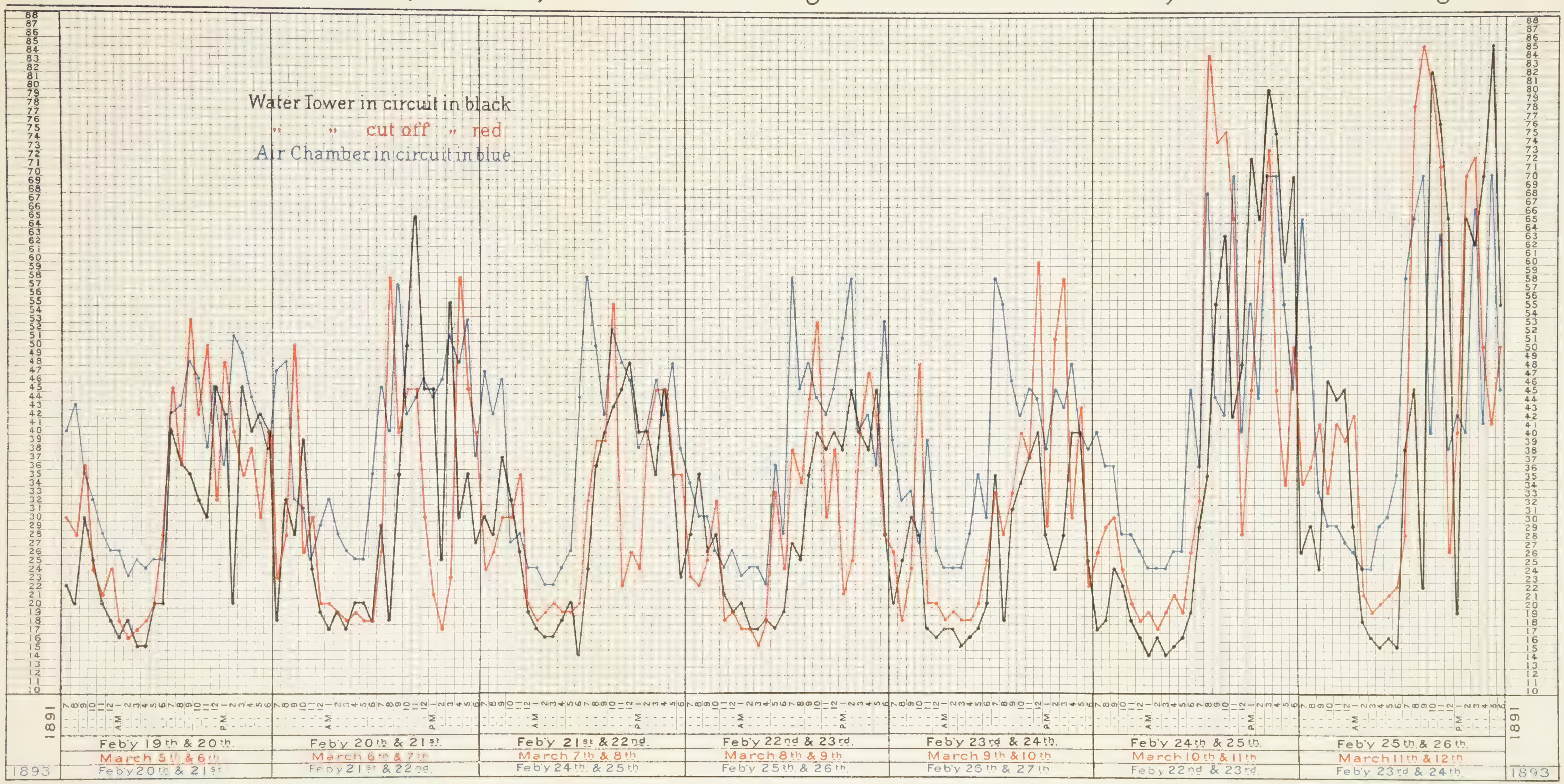
POUNDS PRESSURE REVOLUTIONS ENGINE

Effect of Air Chamber.



18

Diagram showing Variation of Engine Speed for Seven Days including Two Days of Hydrant Flushing. [Hydrant Flushing.]



Taken every hour commencing 7 P.M. ending 6 A.M.

Again at the Park Hotel the pressure dropped with air chamber from 83 to 75 pounds in 6 seconds at the rise of the elevator and increased from 75 to 83 pounds at the stop of elevator in 6 seconds. Without air chamber the pressure dropped from 85 to 65 pounds in 20 seconds and returned to 85 pounds again in 20 seconds. You will also note a continual vibration of the pressure guage without air chamber of from 6 to 7 pounds, whereas with air chamber the continuous vibration is within 3 pounds. This is with one lift of the elevator. The test was very severe in all its phases and shows the maximum and minimum during the time. The air chamber shows beyond a doubt that it is the climax for a direct pressure system.

METERS.

Our meter system is gradually increasing, there having been added during the last year 126, making 673 meters now in use. The city furnishing the meters free to the water takers, and the requisite improvements increasing the construction expenses; we have been unable to put all services at $8 per annum and over, under the meter system, and have only placed them on all new services under your rules. The amount expended for meters last year was $1,238.45. The total expenditure for meters thus far has been $15,864.22, a nominal sum if we consider the cost to the city in providing for more water, probably a lake connection, which we all abhor, and additional machinery, on account of the daily pumpage increasing each year, for each taker reaching to 807 gallons per day in 1888, when we adopted the meter system.

We now have 1,701 water takers, calculating only on 807 gallons would amount to an average of 1,452,600 gallons per day, being our present full capacity and nothing to spare for fire protection, whereas under the meter system we now have plenty of water for the next 2 to 4 years and can gradually add as required. We pumped the last year 432 gallons of water to each taker, or 52½ gallons per capita calculating on 14,000 inhabitants, and only two-fifths of our water

takers are under meters. The above includes 12,000,000 gallons used for flushing and 7,945,100 gallons used for fire protection, drinking fountains and city purposes, and 5,990,400 gallons used for street sprinkling, a total of 25,935,500 gallons, deducting the above makes the actual pumpage for each taker 390 and 47 gallons per capita. We also adopted a reduced graded meter rate, which has lessened our water receipts in comparison with last year.

PERMITS.

During the year ending September 30, 1893, I have issued 147 original and 78 extension permits making total takers to date 1,701.

WATER RENTS.

The annual revenue of the 1,701 water takers was $16,-201.70, from water permits $298,00, a total of $16,499.70, an increase over last year of $1,168.87 with the reduced meter rate. The average for each taker was $9.52½.

OPERATING EXPENSES.

The operating expenses were for the year ending Sept. 30, 1893, $10,458.79, an increase over last year of $573.45, the additional cost of coal being $384.07, another fireman being added for night service and being obliged to employ a laborer steadily for flushing and taking care of hydrants and valves. The surplus reached the sum of $5,742.91.

CONSTRUCTION EXPENSES.

The construction, repairs, meters, extensions and improvements for the year ending Sept. 30, 1893, was $19,-923.29.

MONTHLY RECORD OF THE AMOUNT OF WATER PUMPED DURING THE YEAR AND COAL CONSUMED.

MONTHS.	Gallons of water pumped.	Revolution of large engine.	Revolution of small engine.	Av. steam pressure.	Av. water pressure.	Av. vacuum in inches.	Pounds of coal consumed.	Ashes, in lbs.	Net combustibles.	Duties in foot lbs. per 100 lbs. net combustible
October, 1892.	19,762,850	....	1,577,000	70	82	18	120,000	19,200	100,800	33,987,200
Nov., 1892....	18,837,500	....	1,507,000	70	82	17½	90,800	14,528	76,272	42,806,400
Dec., 1892....	21,634,000	166,000	1,441,000	70	82	19	109,000	17,440	91,560	41,131,200
January, 1893.	24,087,500	....	1,948,000	70	82	21	103,600	16,576	87,024	48,614,400
Feb., 1893....	21,333,500	98,000	1,561,000	70	82	18	93,200	14,912	78,288	47,216,000
March, 1893..	23,610,200	262,000	1,649,600	70	82	19½	104,800	16,768	88,032	46,544,300
April, 1893...	19,817,500	86,000	1,411,000	70	82	18	90,000	14,400	75,600	45,614,400
May, 1893....	24,122,000	685,500	696,000	70	82	21	122,400	19,584	102,816	41,145,000
June, 1893....	21,993,750	....	1,659,500	70	82	18½	117,400	18,784	98,616	36,575,000
July, 1893 ...	23,672,000	112,000	1,676,500	70	82	20	122,400	19,584	102,816	40,845,000
August, 1893.	26,406,750	554,000	1,167,500	70	82	22	122,200	19,552	102,648	45,452,800
Sept., 1893....	22,968,750	....	1,847,000	70	82	19½	106,400	17,024	89,326	43,961,100
Total.....	268,246,300	1,963,500	17,704,100	70	82	19½	1,302,200	208,352	1,093,848	av.42,903,000

Prepared by Chief Engineer Peter Gauer.

RECORDS OF FIRES DURING YEAR.

Date.	Time.	Duration.	Gallons of water for fire.	Pressure at station in lbs.	
Oct. 13, 1892	12:20 a. m.	20 m	6,000	70–80	
Oct. 17, 1892	1:50 p. m.	10 m	2,000	75–80	
Oct. 23, 1892	5:30 p. m.				False alarm.
Nov. 8, 1892	5:45 p. m.				False alarm.
Dec. 13, 1892	7:30 a. m.				False alarm.
Jan. 2, 1893	1:30 p. m.				False alarm.
Jan. 3, 1893	9:25 a. m.				False alarm.
Jan. 28, 1893	5:00 a. m	15 m	3,000	70–80	
Jan. 31, 1893	10:30 a. m.				False alarm.
Feb. 23, 1893	3:35 a. m.	40 m	12,000	80–85	
Mar. 19, 1893	11:20 a m.				False alarm.
April 3, 1893	7:00 p. m.				False alarm.
April 25, 1893	9:25 p. m.	2h 10m	45,400	80–95	
May 1, 1893	12:20 p. m.	17 m	6,800	85–105	
May 14, 1893	1:15 a. m.	30 m	9,000	90–110	
May 25, 1893	9:15 p. m.				False alarm.
May 30, 1893	9:25 p. m.	15 m	6,000	80–85	
June 17, 1893	11:20 a. m.	15 m	4,500	76–80	
June 20, 1893	4:25 p. m.	40 m	18,000	80–110	
June 21, 1893	10:45 a. m.	10 m	4,000	80-85	
July 4, 1893	6:15 a. m.				False alarm.
July 4, 1893	10:35 p. m.	25 m	10,000	90–100	
July 26, 1893	10:35 a. m.				False alarm.
Aug. 24, 1893	7:10 p. m.	10 m	2,000	75–78	
Aug. 27, 1893	2:30 p. m.				False alarm.
Sept. 17, 1893	8:35 p. m.				None taken.
Sept. 28, 1893	8:45 a. m.				None taken.
Total			128,700		

Prepared by Chief Engineer, Peter Gauer.

FIRE ALARM.

During the year the city erected the Gamewell Fire Alarm Telegraph System, connecting the pumping station with a gong, striking, giving us the number of the box, and then to blow the whistle. This method is liable to confuse. The whistle ought to be connected direct same as the gongs and the alarm given all at the same time, no error could then possibly happen in the alarm from the pumping station. The city ought to make this change early the coming season.

Signals of the fire alarm from bells and whistle are as follows, and is same number of blows as number of box:

SIGNAL BOXES.

Box. *Location.*

3 — Fuller & Johnson Works, 3 blows.

FIRST WARD—
12 -- Wisconsin Av. and Gorham St.
14 — State, Gilman and Broom.
16 — Mifflin and Broom.
18 — State and Fairchild.

SECOND WARD —
21 — Washington Av. and Canal.
23 — Dickinson and Dayton.
24 — Johnson and Few.
26 — Johnson and Patterson.
28 — Pinckney, Mifflin and Hamilton.

THIRD WARD —
31 — Pinckney and Wilson.
34 — Wilson and Blair.

FOURTH WARD —
41 — Main, Carroll and Hamilton.
43 — Wilson and Broom.
45 -- W. Main, at C., M. & St. P. tracks.
46 — Washington Av. and Brooks.

FIFTH WARD —
51 — University Av. and Lake.
53 — West Johnson and Park.
54 — University Av. and Mary.

SIXTH WARD —
61 — Main and Blount.
62 — Jenifer and Brearly.
64 — Jenifer and Baldwin.

INSTRUCTIONS FOR OPERATING FIRE ALARM BOX.

Key can be had at any one of the nearest houses to the boxes.

Unlock the door, pull the hook all the way down and let go. Do not jerk the hook down and up, but pull it down steadily as far as you can.

Wait at the box until the department arrives, and inform them where fire is.

The tower bell will strike the number of the box pulled. Thus — for box 34, the bell at the tower will strike and the whistle will blow - - - - - - - three blows, a short pause, then four blows; after which a longer pause. The above will be repeated three additional times. The whistle will give the alarm twice.

Each key is registered. Do not attempt to remove the key; it will be released and returned when the fire is out.

Signals for use of department only, are as follows:

Fire out — one tap.

More pressure — two taps.

Second alarm — two taps repeated.

SUMMARY.

Population by census of 1890, 13,246.

Kind of engines—Two non-condensing Reynolds-Corliss with Knowles pump combined.

Capacity—1,500,000 and 2,500,000 per day.

System—Direct pressure.

Source of water—10 artesian wells.

Number of days pumped	365
Average pumping time per day in hours	24
Number of gallons pumped during year	268,246,300
Number of gallons pumped per month	22,353,858
Number of gallons pumped per day	734,921
Total number of water takers	1,701
Daily average amount pumped for each water taker	432
Greatest amount pumped during the year	1,056,000
Smallest amount pumped during the year	462,500
Difference in consumption during the year	593,500
Number of gallons pumped for 1 cent of fuel	783½
Average head pumped in feet	211½
Dynamic head on pump by gauge pressure	$91\frac{8}{10}$
Total revolutions of large engine during the year	1,963,500
Total revolutions of small engine during the year	17,704,100
Number of gallons pumped to 1 lb. of coal	206
Total amount of coal consumed in tons during the year, lbs.	1,302,200
Total amount of coal consumed in tons during the year	$651.\frac{200}{2000}$
Total amount of coal consumed per month	108,516
Total amount of coal consumed per day in lbs.	3,567
Total amount of coal per hour in lbs.	148½
Total amount of coal per hour per square foot of grate surface	$5\frac{23}{25}$

Net combustibles during the year in lbs	1,093,848
Net combustibles per month in lbs	91,154
Net combustibles per day in lbs	2,997
Net combustibles per hour in lbs	$124\frac{21}{24}$
Net combustibles per square foot of grate surface in lbs	5
Average non-combustibles in lbs. per day	570
Per cent. of non-combustibles	$16\frac{9}{10}$
Kind of coal, Anthracite Pea.	
Price of coal per ton	$5.95
Cost of coal during the year	$3,874.\frac{04}{100}$
Cost of coal to 1,000,000 to raise $211\frac{1}{2}$ feet high	$14\frac{45}{100}$
Cost of coal to 1,000,000 one foot high	6 cts. $8\frac{1}{2}$ mills
Duty pounds of water raised one foot high with 100 pounds of net combustible coal	42,903,000

SERVICE CONNECTIONS.

As recommended to your honorable body for the city to do its own laying of service connections instead of as by contract heretofore done on account of the continous complaint the condition the streets were left in and especially the macadamized streets by the contractor, you decided to do so. A great many taps had to be put in on the macadamized streets, but we have yet to hear of one complaint; special pains were taken, all the material carefully replaced as found before it was removed, and there will be no settling of trenches when spring arrives. Notwithstanding the care and time it took in doing this work, it cost the city 18 cents less per service than the previous year, one hundred and sixty taps were made and services laid during the year. The following table shows on what streets services were placed the past year, size and number of feet on each street, and the total.

During the year we laid 3723 feet of services which brings the number of feet of services to 46,935 or $8\frac{3695}{5280}$ miles.

TABLE SHOWING SERVICE PIPE NOW DAID.

Street or Avenue.	$\frac{5}{8}$ inch.	$\frac{3}{4}$ inch.	$1\frac{1}{2}$ inch.	Total.
Blair	48	....	....	48
Broom	57	....	....	57
Blount	29	....	....	29
Butler	144	....	....	144
Baldwin	29	....	....	29
Clymer	86	....	....	86
Charter	96	....	....	96
Carroll	58	....	....	58
Carroll	....	19	....	19
Dayton	269	....	....	269
Doty	48	....	....	48
Francis	29	19	....	48
Gorham	250	....	....	250
Gilman	19	....	....	19
Henry	186	....	29	215
Hamilton	29	....	....	29
Hancock	67	....	....	67
Johnson	423	....	....	423
Julia	19	....	....	19
Jenifer	67	....	....	67
Lake	58	....	....	58
Livingston	48	....	....	48
Langdon	....	19	....	19
Main	125	15	....	140
Mifflin	135	....	....	135
Mendota Court	38	....	....	38
Mills	38	....	....	38
Patterson	145	....	....	145
Park	19	....	....	19
Pinckney	11	....	....	11
Rutledge	133	29	....	162
State	221	29	....	250
Spaight	57	....	....	57
University Ave	111	....	....	111
Wilson	168	....	....	168
Washington Ave	232	....	....	232
Williamson	172	....	....	172
Total	3,564	130	29	3,723

NEW MAINS.

During the year we laid 2875 feet of 12-inch pipe for suction to ninth and tenth well, 5374 feet of 4-inch cast iron pipe, 300 feet of 2-inch, 825 feet of $1\frac{1}{2}$-inch and 40 feet of 1-inch lead pipe. The lead pipe was placed on ends of streets to obviate dead ends. We located six hydrants, nine valves and one 2-inch cut-off on Patterson

street and one 1½ on S. Livingston street, for lead pipe also four valves on well suction and divided University Avenue between Park and State streets, by locating a valve on the ave., off from Francis street on the west side of above street.

The following table shows the extensions made during the year, giving size, where laid and the number of feet, also were hydrants and valves were placed:

Street or Avenue.	4-inch	No. of Pieces	12 inch.	No. of Pieces	Hydrants.	Valve.	Lead Pipe.
S. Butler street	462	38			1–4 in.	4 in.	
Charter street	412	34				4 in.	
W. Dayton street	1329	111			1–4 in.	2–4 in.	
S. Dickinson street	960	80			2–4 in.		
Francis street	156	13			1–4 in.		
N. Livingston street							40 ft. 1 in
S. Livingston street						Cut-off.	495 ft. 1½
Park street	425	35				1–4 in.	
N. Patterson street						Cut-off.	300 ft. 2
S. Patterson street	350	29				1–4 in.	
Rutledge street	630	52				1–4 in.	330 ft. 1½
Spaight street	650	54			1–4 in	1–4 in.	
University avenue						1–6 in.	
SUCTION.							
E. Johnson street			675	56		1-12 in.	
N. Livingston street			1100	92		1–10 in. 1–12 in.	
S. Patterson street			450	38		1–8 in.	
E. Washington ave			650	54			
Total	5374	446	2875	240	6	16	1162

The laying of the suction pipe on Johnson street was very trying and expensive, it being macadamized, requiring a four-foot trench to place a 12-inch pipe and replacing all earth that had been removed, screening the broken stone and packing it with tampers, and to leave the street practically in the same condition as found, not even requiring the steam roller after we were done.

We now have $28\frac{3861}{5280}$ miles of mains, 146 hydrants, 175 valves and $\frac{3404}{5280}$ miles of lead water mains and 4,457 feet of suction pipe.

CONSTRUCTION FUND.

As stated in my last report, the common council failing to set apart any moneys for water works construction on account of the shortage in the general fund, being entitled to three-tenths of one per cent. or $19,544.80, compelling us to rely solely on the net receipts of the water rents to cover our construction expenses, with the vast sum for the construction and extension of 1893 required, and no possible postponement, compelled your honorable body to issue bonds to the amount of $10,000 at 5 per cent., adding to our indebtedness and which did not nearly cover our construction expenses. We expected that the coming year the common council would set aside for the water fund $10,000, exclusive of the $5,000 to carry off the bonded indebtedness. Your honorable body finally fixed the amount required at $8,000, but it again was cut down to $3,000, on account of the shortage in the general fund, which will leave us in such a condition that we can not make any extensions (there are now already calls for new mains).
The amount due the first of January will be for the tenth well, $2,408.00; pipes, etc., for suction of both wells and labor for tenth well, $3,343.23; a coal bill of $1,899.68; meters, services, service and valve boxes, valves, lead pipe, etc., and operating expenses till January 12, 1894, will amount to $5,449.16, a total of $13,100.07.

The anticipated water rents will amount to $8,600, the balance on hand October 1, 1893, was $2,982.41, adding the $3,000 set aside will make a total of $14,582.41, only $1,482.34 left to carry on the operating expenses until July 1, 1894, when an anticipated water rent of $8,000 will come to our rescue to carry on the balance of the year. Thus you will see that it will be impossible to extend the plant to any extent. All we possibly can do is to take care of the service connections and place a limited amount of meters. Some provision ought to be made in an endeavor to help the water works along as much as possible, an institution that is the best paying investment the city has ever made,

and only in its infancy, and aid us to carry along the enterprise successfully, to meet the demands made upon them and not place them in a Sisyphean condition. I trust that the sum of $10,000 exclusive of the $5,000 provided for will be set aside at the annual meeting to meet the requirements of 1894 and 1895.

RETROSPECT.

We are now leaving behind the eleventh year of our existence and entered upon the twelfth. During these eleven years we have increased our plant from $95,000, being the cost of the original construction, to $271,435.96. Our repairs have been $2,185.58. Our bonded indebtedness is on original plant, $27,000 which was increased the past year $10,000. Our receipts during same period was for permits $3,600,00, from water rents, $128,727.77. The operating expenses were $93,090.60; surplus net receipts, $35,637.17, and this was accomplished with one of the lowest water rates in existence, and no other resources. During same period we have increased our mains from 11½ miles to 28⅔ miles and carried them to the outskirts in the remotest parts and through low and marshy soil to give all our citizens that desired, an opportunity to use the *good and healthy city water direct from mother earth beyond even a trace of organic matter.*

Madison can feel proud of her water works, for their efficiency and magnitude, being among the foremost in the country. Your honorable body having this institution in charge ought at all times meet the kind assistance and forbearance in furthering the interest intrusted to your diligent zeal and watchfulness to still increased prosperity; and in

CONCLUSION.

I desire to take the occasion to express my grateful appreciation to each member of the board for the ever ready assistance and valuable counsel rendered me in the discharge of my duties, and with this continuous kind aid, I

shall endeavor to labor for the continuous success and increased results of the 'Madison City Water Works," to meet your approbation and that of our citizens.

I herewith also desire to express my utmost satisfaction and gratitude to the chief engineer, meter inspector, secretary, engineers, fireman, and laborers for their ever ready, prompt and faithful discharge of their respective duties to carry on the work successful and prosperous.

Respectfully submitted,

JOHN B. HEIM,
Superintendent.

MAP.

The annexed map of the Water Works system, accompanying the report, shows the complete system, including the projected mains, the size of the pipe and where laid, location of hydrants and valves up to date. The pressure at every hydrant in the city is also given in red figures, being at the uniform pressure always carried, 85 lbs. at guage in pumping station, which is the comparison of 88 lbs. at pump.

For instance, map will show pressure at (Storer's) corner Pinckney and Gilman streets, 48 lbs., a difference of 37 lbs., by guage, this is the greatest height in the city, at Park hotel 53 lbs., a difference of 32 lbs., at the same point carrying 100 lbs., it will be 68 lbs.

LIST OF FIRE HYDRANTS.

For the benefit of the fire department and water works combined, the following table of fire hydrants is arranged and kept up, the new hydrants placed being also added. We have added six hydrants the last season.

No.	*Location.*
1	Southwest corner on Dayton and Bruen streets.
2	Southeast corner Charter and Dayton streets.
3	Southwest corner Johnson and Charter streets.
4	Southwest corner Johnson and Brooks streets.
5	Southwest corner University avenue and Park street.
6	Northwest corner State and Park streets.
7	Southwest corner Univerisity avenue and Lake street.
8	Southeast corner State and Lake streets.
9	Southwest corner Langdon and Lake streets.
10	Southwest corner Langdon and Francis streets.
11	Southwest corner State and Francis streets.
12	Southeast corner State and Gilman streets.
13	Southeast corner Gorham street and University avenue.
14	Southeast corner State and Gilman streets.
15	Southeast corner Johnson and Broom streets.
16	Southeast corner State and Johnson streets.
17	Southeast corner Gorham and Henry streets.
18	Southeast corner Gilman and Henry streets.
19	Northeast corner Langdon and Henry streets.
20	Northeast corner Langdon and Carroll streets.
21	Southeast corner Johnson and Carroll streets.
22	Northeast corner Wisconsin avenue and Dayton streets.

No.	Location.
23	Northeast corner Gorham street and Wisconsin avenue.
24	Northeast corner Gilman street and Wisconsin avenue.
25	Southeast corner Gilman and Pinckney streets.
26	Southeast corner Gorham and Pinckney street.
27	Northeast corner Johnson and Pinckney streets.
28	Southwest corner Webster and Mifflin streets.
29	Northwest corner Webster and Hamilton streets.
30	Northeast corner Johnson and Butler streets.
31	Northeast corner Gorham and Butler streets.
32	Northeast corner Johnson and Canal streets.
33	Northwest corner opposite pumping station.
34	Southeast corner Gorham and Blair streets.
35	Southeast corner Gorham and Blount streets.
36	Southeast corner Gorham and Livingston streets.
37	North corner Brearly and Gorham streets.
38	Northeast corner Johnson and Few stsreet.
39	Northeast corner Dayton and Baldwin streets.
40	East corner Dickinson and Mifflin streets.
41	East corner Dickinson and North Washington avenue.
42	Northeast corner East Washington avenue and Canal street.
43	Northeast corner East Washington avenue and Butler street.
44	Southeast corner Main and Webster streets.
45	South corner King and Clymer streets.
46	South corner Wilson and Butler streets.
47	North corner Canal and Main streets.
48	East corner Canal and Wilson streets.
49	South corner Williamson and Blair streets.
50	Southeast corner Williamson and Blount streets.
51	Southeast corner Williamson and Livingston streets.
52	West corner Williamson and Patterson streets.
53	West corner Williamson and Bearly streets.
54	North corner Williamson and Ingersoll streets.
55	Northeast corner Spaight and Ingersoll streets.
56	Southeast corner Spaight and Brearly streets.
57	East corner Patterson and Jenifer.
58	Northeast corner Wilson and Pinckney streets.
59	Southeast corner Clymer and Pinckney streets.
60	Northeast corner Monona avenue and Wilson street.
61	Southeast corner Wilson and Clymer streets.
62	Southeast corner Clymer and Carroll streets.
63	East corner Fairchild and Clymer streets.
64	Northeast corner Wilson and Henry streets.
65	Northeast corner Wilson and Broom streets.

No.	Location.
66	East corner Bassett and Wilson streets.
67	Southeast corner Main and Chi., Mil. & St. Paul R. R. track.
68	Southeast corner Main and Bedford streets.
69	Northeast corner Main and Bassett streets.
70	Southeast corner Main and Broom streets.
71	Southeast corner Main and Henry streets.
72	Southeast corner West Washington avenue and Henry street.
73	South corner West Washington avenue and Broom street.
74	South corner Mifflin and Henry streets.
75	Southeast corner Mifflin and Henry streets.
76	West corner capitol park.
77	Front of city hall.
78	North corner capitol park.
79	Front of market.
80	East corner capitol park.
81	Front of Pioneer block.
82	South corner capitol park.
83	Front of Episcopal church.
84	Madison Manufacturing Company.
85	Southwest corner Mifflin and Bassett streets.
86	Northwest corner Dayton street, near Catfish.
87	Opposite Ball Bros.' foundry.
88	Northeast corner Hancock and Mifflin streets.
89	Northeast corner Blair street and East Washington avenue.
90	Northeast corner Langdon and Park streets.
91	Southeast corner Main and Monona street.
92	West corner University avenue and Warren street.
93	Northwest corner Spaight and Few streets.
94	Northwest corner Rutledge and Baldwin streets.
95	Northeast corner Pinckney and Dayton streets.
96	Southeast corner Dayton and State streets.
97	Southeast corner Butler and Mifflin streets.
98	Northeast corner Johnson and Blair streets.
99	Northeast corner Johnson and Blount streets.
100	Northeast corner Johnson and Livingston streets.
101	Northeast corner Johnson and Patterson streets.
102	Northeast corner Johnson and Brearly streets.
103	East corner University avenue and Brooks street.
104	East corner University avenue and Mills street.
105	East corner University avenue and Charter street.
106	East corner University avenue and Bruen street.
107	Between Science Hall and Machine Shop, University grounds.
108	Southwest corner West Washington avenue and Bassett street.

No.	*Location.*
109	Northeast corner Baldwin street and East Washington avenue.
110	Northwest corner Baldwin and Main streets.
111	Southeast corner Baldwin and Williamson streets.
112	Northwest corner Baldwin and Jenifer streets.
113	East corner Francis street and University avenue.
114	South corner Francis and Dayton streets.
115	North corner Dayton and Murray streets.
116	South corner Murray and Johnson streets.
117	Greenbush addition, corner Washington avenue and Park street
118	Southwest corner Williamson and Few streets.
119	Southeast corner Mills and Dayton streets.
120	Southeast corner Mills and Mound streets.
121	Southeast corner Mills and Washington avenue.
122	Northwest corner Clymer and Bassett streets.
123	Northwest corner Dayton and Henry streets.
124	Northwest corner Hancock and Main streets.
125	Southwest corner Jenifer and Ingersoll streets.
126	Northwest corner Patterson and Gorham streets.
127	Northwest corner Johnson and Baldwin streets.
128	Opposite Dow's mill.
129	Northwest corner Julia and State streets.
130	At Gas works.
131	Northeast corner Lake and Johnson streets.
132	Northeast corner East Washington avenue and Blount street.
133	Northeast corner Blount and Mifflin streets.
134	Southeast corner West Washington avenue and Bedford st.
135	Southeast between Monona street and Junction.
136	At West Madison, front of Railroad Hotel.
137	Southeast corner Few and Mifflin streets.
138	Northwest corner Mary and State streets.
139	Northeast corner Dickinson and Williamson streets.
140	Rear of Fuller & Johnson works, near Mifflin street.
141	Northeast corner Main and Butler streets.
142	North corner of Dayton and Park streets.
143	Southwest corner of Dickinson and Jenifer streets.
144	Southeast corner of Dickinson and Rutledge streets.
145	North corner of Francis street and Lake Mendota.
146	East corner of Spaight and Patterson streets.

LIST OF VALVES.

No.	*Location.*
1	Johnson street off from Bruen street, east.
2	University off from Park street, east.
3	Park street off from University avenue, north.
4	Park street off from State street, north.
5	Lake street off from University, avenue north.
6	Lake street off from State street, north.
7	Lake street off from Langdon street, north.
8	Langdon street off from Francis street, east.
9	Langdon street off from Wisconsin avenue, southwest..
10	State street off from Lake street, east.
11	State street off from Gorham street, east.
12	State street off from intersection of Carroll and Mifflin streets.
13	Gilman street off from State street, east.
14	Gorham street off from State street, west.
15	Gorham street off from State street, east.
16	Johnson street off from State street, west.
17	Johnson street off from State street, east.
18	Gilman street off from Wisconsin avenue, northeast.
19	Gilman street off from Wisconsin avenue, southwest.
20	Gorham street off from Carroll street, northeast.
21	Gorham street off from Wisconsin avenue, northeast.
22	Gorham street off from Wisconsin avenue, southwest.
23	Wisconsin avenue off from Gorham street, southeast.
24	Wisconsin avenue off from Gorham street, northwest.
25	Butler street off from Gorham street, northwest.
26	Gorham street off from Blair street, northeast.
27	Livingston street, off from Johnson street, northeast.
28	Brearly street off from Johnson street, northeast.
29	Johnson street off from State street, southwest.
30	Johnson street, off from State street, northeast.
31	Johnson street off from Wisconsin avenue, southwest.
32	Johnson street off from Wisconsin avenue, northeast.
33	Johnson street off from intersection Butler and Hamilton, s. w.
34	Dayton street off from Wisconsin avenue, northeast.
35	Mifflin street off from intersection of Carroll and State, s. w.
36	Mifflin street off from Carroll and State streets, northeast.
37	Wisconsin avenue off from Mifflin and State streets, northeast.
38	Mifflin street off from Pinckney street, southwest.
39	Mifflin street off from Webster street, northeast
40	Webster street off from Hamilton street, east.
41	Pinckney street off from Mifflin street, northwest.

No.	*Location.*
42	Pinckney street off from Mifflin street, northeast.
43	E. Washington avenue off from Pinckney street, northeast.
44	Pinckney street off from Main street, northeast.
45	Pinckney street off from Main and King streets, south.
46	Pinckney street off from Wilson street, southeast.
47	Main street off from Pinckney and King streets, north.
48	King street off from Main street, east.
49	King street off from intersection of Butler and W. Wilson streets, east.
50	Canal street off from Johnson street, northeast.
51	Canal street off from E. Washington avenue, southwest.
52	Mifflin street off from Canal street, northeast.
53	Main street off from Canal street, northeast.
54	Main street off from Canal street, southwest.
55	Main street off from intersection of Pinckney and King sts., n
56	Clymer street off from King street, north.
57	Wilson street off from King street, south.
58	Canal street off from Wilson street, northeast.
59	Blair street off from Main street, northeast.
60	Blair street off from Williamson street, north.
61	Williamson street off from Blair street, southwest.
62	Williamson street off from intersection of Jenifer st., n. e.
63	Williamson street off from Patterson street, northeast.
64	Patterson street off from Wliiamson street, southeast.
65	Williamson street off from Ingersoll street, northeast.
66	Ingersoll street off from Williamson street, southeast.
67	Spaight street off from Ingersoll street, northeast.
68	Jenifer street off from Patterson street, southwest.
69	Wilson street off from Monona avenue, northeast.
70	Wilson street off from Monona avenue, southwest.
71	Monona avenue off Main street, southeast.
72	Main street off from Pinckney street, southwest.
73	Main street off from Carroll street, northeast.
74	Main street off from Carroll street, southwest.
75	Carroll street off from Main street, southeast.
76	W. Washington avenue off from Carroll street, southwest.
77	Carroll street off from Mifflin street, southeast.
78	Broom street off from Mifflin street, northeast.
79	Mifflin street off from Broom street, southwest.
80	W. Washington avenue off from Broom street, southwest.
81	Henry street off from Mifflin street, southeast.
82	Henry street off from Main street, southeast.

No. *Location.*

83 Henry street off from Wilson street, southeast.
84 Clymer street off from Basset street, northeast.
85 Bassett street off from Main street, southeast.
86 Main street off from Basset street, southwest.
87 Main street off from railroad track, near St. P. R. R., N. E.
88 Pumping Station grounds off from Johnson street, 16-inch.
89 Pumping Station grounds off from Gorham street, 10 inch.
90 Fuller & Johnson Manufacturing Co.'s buildings, 4 inch.
91 Broom street off from Main street, southeast.
92 Pinckney street off from Johnson street, northeast.
93 Henry street off from Gorham street, northeast.
94 Wilson street off from Basset street, southwest.
95 Butler street off from Hamilton street, northeast.
96 Mifflin street off from Canal street, southwest.
97 Blair street off from East Washington avenue, southeast.
98 Blair street off from Johnson street, southeast.
99 Johnson street off from Canal street, southwest.
100 Johnson street off from Livingston street, southwest.
101 Johnson street off from Livingston street, northwest.
102 Johnson street off from Brearly street, southwest.
103 Carroll street off from Johnson street, northeast.
104 Dayton street off from State street, southwest.
105 Fairchild street off from Mifflin street, southeast.
106 Butler street off from Wilson street, northeast.
107 University avenue off from Park street, west.
108 Warren street off from University avenue, north.
109 Clymer street off from Monona avenue, northwest.
110 Clymer street off from Monona avenue, southwest.
111 Blair street off from Johnson street, northwest.
112 Webster street off from King street, north.
113 Bassett street off from W. Washington avenue, northwest.
114 Brooks street off from University avenue, south.
115 Mills street off from University avenue, south.
116 Dickinson street off from E. Washington avenue, n rthwest.
117 Baldwin street off from E. Washington avenue, northwest.
118 Baldwin street off from Williamson street, northwest
119 Williamson street off from Baldwin street, southeast.
120 Baldwin street off from Rutledge street, northwest.
121 Spaight street off from Baldwin street, southeast.
122 Jenifer street off from Brearly street, northeast.
123 Bedford street off from Main street, southeast.
124 N. Broom street off from Mifflin street, northwest.

No.	*Location.*
125	N. Broom street off from Gorham street, southeast.
126	S. Broom street off from Main street, southeast.
127	Francis street off from University avenue, south.
128	Dayton street off from Francis street, west.
129	Murray street off from Dayton street, north.
130	Johnson street off from Park street, east.
131	Langdon street off from Lake street, west.
132	Pinckney street off from Johnson street, northwest.
133	Greenbush addition Main street, east side of bridge.
134	Greenbush addition intersection Main street, W. W h. ave.
135	Greenbush addition Park street off from W. Wash. ave., south.
136	Dayton street off from Baldwin street, northeast.
137	Henry street off from Gilman street, southeast.
138	Mills street off from Johnson street, north.
139	Mills street off from W. Washington avenue, south.
140	W. Washington avenue off from Park street, east.
141	Clymer street off from Bassett street, northeast.
142	Henry street off from Mifflin street, northwest.
143	Dayton street off from Broom street, southwest.
144	Carroll street off from Johnson street, northeast.
145	Hancock street off from Main street. northwest.
146	Jenifer street off from Ingersoll street, southwest.
147	Jenifer street off from Baldwin street, northeast.
148	W. Washington avenue off from Bassett street southwest.
149	Blount street off from Main street northwest.
150	Blount street off from Johnson street southeast.
151	Few street off from Dayton street southeast.
152	Mifflin street off from Baldwin southwest.
153	Dayton street off from Wisconsin avenue northwest.
154	Mary street off from University avenue east.
155	Carroll street off from Wilson street, southeast.
156	Gilman street off from State street, west.
157	Gilman street off from University avenue, east.
158	Henry street off from Gilman street, southeast.
159	Fairchild street off from W. Washington avenue, northwest.
160	Broom street, off from Wilson street, southeast.
161	Hancock street off from Mifflin street, northwest.
162	Hancock street off from Johnson street, southeast.
163	Hancock street off from Gorham street, southeast.
164	Patterson street off from Gorham street, southeast.
165	Williamson street off from Baldwin street, northeast.
166	Dickinson street off from Williamson street, southeast.

No.	Locatiou.
167	S. Butler street off from E. Washington avenue, east.
168	Charter street off from University avenue, south.
169	W. Dayton street off from Mills street, east.
170	W. Dayton street off from Murray street, west.
171	Park street off from Johnson street, south.
172	Rutledge street off from Baldwin street, northeast.
173	Spaight street off from Brearley street, southwest.
174	University avenue off from Francis street, west.
175	S. Patterson street off Jenifer street, southeast.

INVENTORY.

October 1, 1893.

OFFICE.

Two office desks, 1 large table, 1 safe, 1 revolving chair, 6 office chairs, 1 draughting table, 1 map showing pipe line, 1 table copying press.

STORE ROOM.

Two complete Mueller tapping machines, 2 1-in. corporation cocks, 15 $\frac{3}{4}$-in. corporation cocks, 3 $\frac{5}{8}$-in. corporation cocks, 5 $\frac{1}{2}$-in. corporation cocks, 43 service box covers, 17 valve boxes, 2 valve keys, 1 trench pump, 11 pigs of lead, 30 meter boxes, 2 bales hemp, 2 $1\frac{1}{2}$-in. roundway stops for iron pipe, 1 1-in. roundway stop for iron pipe, 1 $1\frac{1}{2}$-in. roundway stop for lead pipe, 1 1-in. roundway stop for lead pipe, 795 lbs. lead pipe.

IN BOILER AND ENGINE ROOM.

1 small Fairbanks coal scale, 1 clock, 1 telephone and extension bell, 6 cuspidors, 1 table, 2 chairs, 1 tool bench, 1 machinist vice 6 in. jaws, 1 pipe vice No. 2, tool closet, 1 two-foot steel square, 1 stock $\frac{1}{8}$ to $\frac{1}{3}$ inch, piper cutter No. 2, 1 ratchet, 1 brace, 5 files, 1 stock $\frac{3}{4}$ to $1\frac{1}{2}$ inch, 1 augur bit $\frac{3}{4}$, 3 drills $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$, taps and reamers, 1 stock $1\frac{1}{2}$ to 2 inches, 5 monkey wrenches, 1 punch, 3 pipe tongs No. 1, 2 and 3, 2 scale picks, 5 cold chisels, 6 caulking tools, 1 $5\frac{1}{2}$ crowbar, 1 18-inch pry bar, 1 hammer, 1 wooden barrow, 1 ladder, 2 scoops, 3 lanterns, 3 oil cans $\frac{1}{2}$ and 1 gallon, 1 boiler torch, 1 iron barrow, 3 water pails, 1 sickle, 1 scythe, 1 breast drill, 1 lawn mower, 1 truck, 2 rakes, 1 Stillson pipe wrench, 1 No. 2 trimo pipe wrench, 1 hoe,

2 hand lamps, 1 grindstone, 1 axe, 1 force pump, 2 oil tanks, 1 pressure chamber, 1 meter test tank, 50 feet rubber hose, 150 feet cotton hose and nozzle, 50 lbs. gear grease, 1 hand power drill, 4 fountain sprays, 9 rubber gaskets 6x9, 19 rubber gaskets 9x14, 4 pounds of $\frac{5}{8}$ round rope packing, 1 pound hemp, 5 glass tubes, 4 pounds square pump plunger packing, 18 pounds rubber sheeting, 1 pound asbestos rope wicking, 19 pounds usudurian sheeting, 23 pump valves, 11 pump valve springs, 2 jack-screws, 1 tag mould, 1 hand-power drill, 4 lbs. rawhide packing, 4 lbs. $\frac{1}{2}$-inch square duck packing, 2 lbs. $\frac{3}{8}$-inch square duck packing, 1 5-inch hydrant valve, 7 4-inch hydrant valves, 1 5-inch waste valve and rod, 4 4-inch waste valves and rods, 2 blacksmith tongs.

FITTINGS.

One $1\frac{1}{2}$-in. tee, 2 2-in. tees, 3 1-in. tees, 5 1-in. ells, 3 $1\frac{1}{4}$-in. ells, 4 1-in. 45° ells, 2 $1\frac{1}{4}$-in. unions, 1 2-in. union, 2 $1\frac{1}{4}$-to 1-in. reducers, 1 $2\frac{1}{2}$x2-in. bushing, 2 $1\frac{1}{4}$x$1\frac{1}{2}$ bushings, 1 $1\frac{1}{2}$-in. plug, 3 2-in. plugs, 1 $2\frac{1}{2}$-in. plug, 2 3-in. plugs, 1 4-in. plug, 1 $1\frac{1}{2}$-in. brass union, 1 $1\frac{1}{4}$-in. brass union, 1 $1\frac{1}{4}$-in. globe valve, 15 ft. $\frac{3}{8}$-in. steam pipe, 15 ft. $\frac{1}{2}$-in. steam pipe, 90 ft. $\frac{3}{4}$-in. steam pipe, 150 ft. 1-in. steam pipe, 15 ft. $1\frac{1}{4}$-in. steam pipe, 30 ft. 2-in. steam pipe.

METER ROOM.

Sixteen $\frac{5}{8}$-inch Crown meters, 3 $\frac{3}{4}$-inch Crown meters, 1 1-inch Crown meter, 1 3-inch Crown meter, 2 $\frac{3}{4}$-inch Hersey meters, 1 $\frac{3}{4}$-inch Nash meter, 1 $\frac{5}{8}$-inch Union meter, 1 $\frac{3}{4}$-inch Union meter, 1 $\frac{5}{8}$-inch London meter, 1 $\frac{3}{4}$-inch London meter, 3 $\frac{5}{8}$-inch covers for Crown meters, 4 $\frac{3}{4}$-inch covers for Crown meters, 8 $\frac{5}{8}$-inch covers for Hersey meters, 7 $\frac{3}{4}$-inch covers for Hersey meters, 1 $\frac{5}{8}$-inch bottom for Hersey me- 3 $\frac{3}{4}$-inch bottoms for Hersey meters, 10 $\frac{5}{8}$-inch piston Hersey meters, 5 $\frac{3}{4}$-inch piston Hersey meters, 2 $\frac{5}{8}$-inch rings Hersey meter, 1 $\frac{3}{4}$-inch ring Hersey meter, 1 $\frac{5}{8}$, 1 $\frac{3}{4}$ and 1 1-inch clock Hersey meter, 26 reducing trains Hersey meters.

TOOL BOX.

1 crowbar, 13 tampers, 1 marking rope, 1 rope tackle, 1 metallic tape line, 1 level, 1 hammer, 2 hemp tools, 1 hardy, 5 diamond chisels, 2 round nose chisels, 3 cold chisels, 4 caulking tools, 1 cape chisel, 1 drill chisel, 1 sledge, 2 chisel bars, 1 hydrant tackle, 1 3-ton differential block, 3 pails, 1 kerosene can, 5 lanterns, 1 hydrant wrench, 1 hydrant packing wrench, 1 valve key.

PIPE YARD.

One lead kettle and furnace, 2 tripods, 12 feet 16-in. cast iron pipe, 192 feet of 12-in. cast iron pipe, 28 feet 10-in. cast iron pipe, 48 feet of 8-in. cast iron pipe, 80 feet of 6-in. cast iron pipe, 550 feet of 4-in. cast iron pipe, 24 feet of 3-in. cast iron pipe, 60 feet of 2-in. cast iron pipe, 1 6-in sleeve, 2 14-in. sleeves, 1 12-in. sleeve, 2 10-in sleeves, 1 8-in. sleeve, 3 6-in. sleeves, 2 4-in. sleeves, 3 3-in. sleeves, 2 4x4x2 tees, 1 8x4 tee, 1 4x4x3 tee, 1 8 to 4 reducer, 1 6 to 4 reducer, 1 4 to 2 reducer, 2 4x4x4x4 crosses, 1 16x16x4x4 cross, 2 4-in. elbows 45°, 1 6-in. elbow 45°, 4 4-in. curves, 3 4-in. off-setts, 4 6-in. off-setts, 2 sets hydrant branches, 2 4-in. hydrants, 2 5-in. hydrants, 164 feet 7-in. well tubing, 1 6-in, Nye vacuum pump.

RULES FOR THE WATER METERS.

The following rules have been adopted by the board of water commissioners, to govern the use of water meters:

SECTION 1. All services which may hereafter be connected with the city water works system shall be connected with the meter furnished by the city, if such services shall include sewerage, cesspool or sprinkling of streets or lawns. And all other services and connection shall be so placed that meters can be attached whenever the board of water commissioners may direct it to be done. The water rent wherefore such meter shall have been placed shall be according to the measurement of the meter used. All water meters shall be placed inside of buildings. From and after January 1, 1892, water meters will be placed on all premises that now have the service connection where the present rate of water rent equals or exceeds eight dollars ($8) per annum, and in connection with all services used for sprinkling purposes where the water rent for sprinkling purposes shall exceed three dollars ($3) per annum; and also in connection with such other services where it shall be discovered that there is a constant flow of water, or no meter being used, or as the board of water commissioners may from time to time deem proper and necessary. All new water services hereafter made for domestic purpose only shall be so constructed and placed that meters can be readily attached whenever the board of water commissioners may order the same to be done.

SECTION 2. The City of Madison will furnish all meters for one building free to consumers. All meters must be placed by a licensed plumber at expense of property owners, and as near as possible to where service pipe enters building. The plumber doing the work must flush pipe thoroughly before connecting meter. The city will repair all meters that are clogged, and if lead chips are found to be the cause a fine of $1.00 will be collected from the plumber doing the work for each and every job so found before issuing another permit to said plumber. No water meter shall be removed or disturbed without first having obtained permission from the superintendent of the water works.

SECTION 3. A check and waste shall be placed between the shut-off cock and meter within one foot of the meter. All meters shall be so

located and placed as to afford easy access thereto, and so that they can can be easily examined and read. In all cases where meters have been ordered and have been supplied, no water from the city water works shall be taken, received or supplied to the building for which the same was constructed and intended except that which shall pass through and be registered by such meter.

SECTION 4. The consumers of the water supplied through any water meter shall make all necessary repairs for the proper operation of such water meter, and in case the City of Madison shall deem it necessary and expedient to repair a defective water meter, the expenses of such repair shall be chargeable to such consumers, and shall be paid at the time such repair was made, and in case of failure to pay for such repair, the superintendent of the water works shall shut off the flow of water furnished through such meter.

SECTION 5. In case that any water meter should fail to register the quantity of water passing through the same, the consumers will be charged at the rate of the average daily consumption registered by such meter before the same became out of repair.

SECTION 6. In all cases where one service connection or yard hydrant does supply two or more separate consumers, premises, tenements, business houses or a block occupied by divers parties, one meter only will be placed at the service connection for either or all of said consumers, and the water rent as registered by said meter shall be chargeable to, and payable by the owner of said premises or buildings.

SECTION 7. The rate of water rent to be charged where such meters are in use shall be according to the schedule rate established by ordinances, the minimum whereof being in all cases five dollars ($5) per annum.

SECTION 8. Water rents where meters have been placed, shall be collected for first six months at the schedule rate. Thereafter as per record of meter the preceding six months in a manner as prescribed in section 13 of water works ordinance. No water meter rental will be charged by the City of Madison.

SECTION 9. The superintendent of the water works system, or any person employed by the board of water commissioners, shall be given free and ready access to the premises and buildings for the purpose of examining or repairing any meter or connection therewith. Any and all meters shall be left in the condition and manner as set by the city, and shall not be interfered with in any manner whatsoever.

SECTION 10. In case of any violation of any of the foregoing rules and regulations, the water supply furnished to the consumer guilty of such violation shall immediately be shut off and shall not be resumed except upon a satisfactory adjustment of all the differences connected therewith, and upon the payment of the sum of one dollar for shutting

off and turning on the water. Anybody violating any of these rules and regulations shall upon conviction thereof, be subjected to a fine not to exceed twenty-five dollars ($25), and the cost of prosecution.

METER RATES.

6,000 cubic feet or less, per six months, per 100 cubic feet						20 cents
Over 6,000 cubic feet and less than 7,000, per six months, per 100 cubic feet						19 cents
Over 7,000	"	"	8,000,	"	"	18 cents
Over 8,000	"	"	9,000,	"	"	17 cents
Over 9,000	"	"	10,000,	"	"	16 cents
Over 10,000	"	"	16,000,	"	"	15 cents
Over 16,000	"	"	17,000,	"	"	14 cents
Over 17,000	"	"	18,000,	"	"	13 cents
Over 18,000	"	"	19,000,	"	"	12 cents
Over 19,000	"	"	20,000,	"	"	11 cents
Over 20,000	"	"	27,000,	"	"	10 cents
Over 27,000	"	"	28,000,	"	"	9 cents
Over 28,000	"	"	29,000,	"	"	8 cents
Over 29,000	"	"	30,000,	"	"	7 cents
Over 30,000	"	"	60,000,	"	"	6 cents
Over 60,000 cubic feet per six months, per 100 cubic feet						5 cents

Minimum, $5.00 per annum.


MAP OF THE
WATER WORKS SYSTEM
OF
MADISON
WISCONSIN.
JOHN B. HEIM, Supt.
EXPLANATION
PROJECTED LINES IN RED
PRESSURE AT HYDRANT IN RED FIGURES
SUCTION PIPE IN RED
LAKE MENDOTA
LAKE MONONA
LAKE WINGRA
UNIVERSITY GROUNDS
UNIVERSITY OF WISCONSIN
BROOKS ADDITION
UNIVERSITY ADDITION
BOWEN'S ADDITION
GREENBUSH
WRIGHT'S ADD.
WINGRA PARK
WARRENS ADDITION
SOUTH MADISON
ORTON PARK
STATE CAPITOL
WATER WORKS
1st. Wd.
2nd Wd.
3rd. Wd.
4th. Wd.
5th. Wd.
6th. Wd.
CHICAGO MADISON & NORTHERN
CHICAGO MILWAUKEE & ST PAUL
CHICAGO AND NORTH-WESTERN
WASHINGTON AVE
SCALE
10 Chains to an Inch.
Mc. C. DODGE TOPR.

TWELFTH ANNUAL REPORT

OF THE

City Water Works.

MADISON, WISCONSIN.

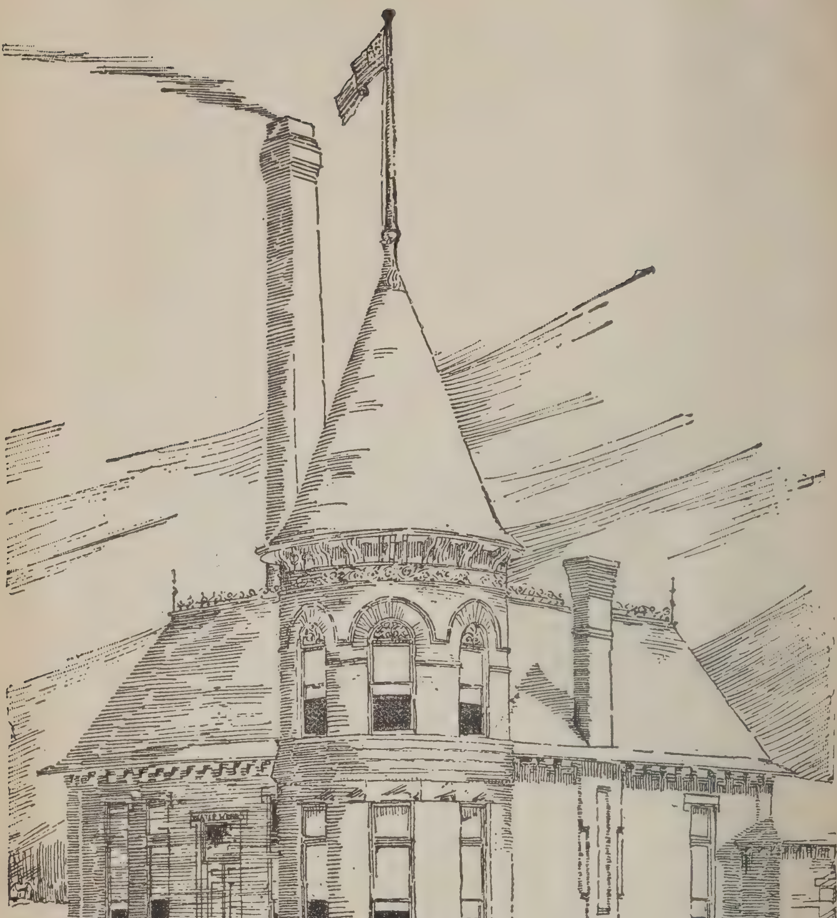
1895.

Compliments of

John B. Heim

Superintendent.

PLEASE EXCHANGE.



BINNER ENG. MADISON · CITY · PUMPING · STATION · GORDON & PAUNACK, ARCH'TS

TWELFTH ANNUAL REPORT

OF THE

BOARD

OF

WATER COMMISSIONERS

OF THE

CITY OF MADISON

FOR THE

YEAR ENDING SEPTEMBER 30, 1894,

TOGETHER WITH THE

REPORTS OF THE SUPERINTENDENT AND SECRETARY.

MADISON, WIS.:
STATE JOURNAL PRINTING COMPANY.
1895.

OFFICERS OF THE WATER WORKS.

WATER COMMISSIONERS.

JOHN R. MELVIN, PRESIDENT	Term expires October 1, 1895.
W. W. WARNER	Term expires October 1, 1896.
J. J. SILBERNAGEL	Term expires October 1, 1897.
JOHN CORSCOT	Mayor *ex officio.*
W. C. NOE	Alderman *ex officio.*

JOHN F. DONOVAN, SECRETARY.

SUPERINTENDENT.

JOHN B. HEIM.

METER INSPECTOR.

NICKOLAS REIF.

ENGINEERS.

PETER GAUER,
JOHN KELLY,
DENNIS DACEY.

FIREMEN.

PATRICK DORIS,
ANTHONY LAWRENCE.

TWELFTH ANNUAL REPORT

OF THE

DEPARTMENT OF WATER WORKS.

REPORT OF THE COMMISSIONERS.

OFFICE OF THE
BOARD OF WATER COMMISSIONERS,
MADISON, WIS., February 16, 1895.

To the Honorable, the Common Council of the City of Madison, Wisconsin:

GENTLEMEN — We herewith submit our Twelfth Annual Report of the condition of the Madison City Water Works for the year ending September 30, 1894. For a statement of the financial transactions of the past year, and a *resumé* of the cost of the system up to this date, we refer you to the report of the Secretary of this Board.

The report of the Superintendent, which is herewith submitted, contains such valuable data, and is such a complete statement of the present needs of the Water Works, that we feel that we can do no better than refer your honorable body to this report as being the best authority on the present status of the system. In the suggestions and recommendations of the Superintendent therein contained, we heartily concur, for we feel that as an increased water supply is the most serious problem to be met with in the management and operation of the works, the very best means must be employed to attain that important end. The general meter system, a cutting off of water motors and sprinkling carts, and a watchful inspec-

tion of private services to prevent the waste of water, will do much towards obviating this difficulty. It is only a question of a few years when the need for an increased water supply will be imperative. Several plans are proposed, as the annexed report suggests. Whatever plan seems most feasible to the Board of Water Commissioners will, in due time, be adopted. But this will not be done until a careful and critical test has been applied to all of the plans suggested and their merits proved by actual use in systems identical with that of this city.

Respectfully yours,

John R. Melvin,
W. W. Warner,
J. J. Silbernagel,
John Corscot,
W. C. Noe,
Commissioners.

SECRETARY'S REPORT.

MADISON, WIS., Feb. 15, 1895.

To the Honorable, the Board of Water Commissioners of the City of Madison, Wisconsin:

GENTLEMEN — I have the honor of submitting to you herewith the twelfth annual Secretary's report of the receipts and expenditures of the Madison City Water Works for the year ending September 30, 1894:

RECEIPTS.

From water rents	$18,560 44	
From water permits	238 00	
From plumbers' licenses	10 00	
From supplies sold, etc	294 50	
From city tax	10,000 00	
Total	$29,102 94	
Balance on hand October 1, 1893	2,982 41	
	$32,085 35	

EXPENDITURES.

Construction		$12,927 69
Operating		11,626 01
Repairs		353 05
Water rent refunded		7 00
Sinking fund		5,000 00
		$29,913 75
Balance on hand October 1, 1894		2,171 60
Total	$32,085 35	$32,085 35

MISCELLANEOUS.

Total receipts from water rents from construction of the works to October 1, 1894	$147,288 21
Total receipts from water permits, same period	3,838 00
Total operating expenses from beginning of works to October 1, 1894	104,716 61
Total cost of extension and construction to October 1, 1894	284,363 65
Total cost of repairs to October 1, 1894	2,538 63
The bonds issued for the construction of the Water Works were	76,000 00
Bonds now outstanding of this series	15,500 00
New issue of bonds	10,000 00
Total amount of bonds outstanding	25,500 00
The annual interest on the same at five per cent. is	1,275 00

Respectfully submitted,

JOHN F. DONOVAN, *Secretary.*

SUPERINTENDENT'S REPORT.

MADISON, WIS., February 15, 1895.

To the Honorable the Board of Water Commissioners:

GENTLEMEN — I have the honor to herewith transmit, in compliance with the provisions of the Water Works ordinance, the Twelfth Annual Report of the department, showing the condition of the works, extensions and improvements that have been made during the past year, and such recommendations that are essential and requisite.

CONDITION.

The condition of the works is good, but the smaller engine and pump will soon have to be replaced with a larger, and would recommend when such is done, with a triple expansion compound condensing. Our works are spreading out very fast. We are adding over 100 takers as usual every year, reaching to 119 the past, making a total of 1,820 takers and 17 permits already issued for the coming year. With this increase of consumers *more water* will be in demand.

WATER.

More water is the all-important, the essential. The city adds the takers, agrees to furnish water, and must do so. This brings the question direct, and something must be done. 1st, The Pohle Air Lift system; 2d, the lowering of the pumps and suction pipe, and enlarging same between Blount street and the station; and 3d, a double system connecting one main with the lake, have been suggested. The first two are the most feasible, and less expensive. With these two we will increase the supply 50 per cent. from our wells and no connection whatever with the lake, whereas

with the double system our domestic supply would not be increased, which is now taxed at times to its utmost, but would incur an expense of at least $60,000, requiring virtually a double Water Works. We may have to adopt both systems, *lowering of pumps and the air lift*, and the expense of both will not reach half the amount of the double system. There must be immediate action. During the past year we pumped 745,224 gallons, on an average, per day, or 409 gallons for each taker, reaching to 1,276,000 gallons per 24 hours for several days during the sprinkling season, reducing our pressure 20 pounds and lowering the reserve basin within 3 feet of the bottom; at that time the street sprinklers were cut off. In 1893 the average pumpage per day was 734,921 gallons, or an average of 432 gallons for each taker, but greatest amount pumped per day was only 1,056,000 gallons. Last year we added two more wells, but the additional patrons will soon take that supply, and where is our fire protection? There are several other methods your honorable body could now adopt, by which water could be saved, that is, refuse to furnish water for motor purposes and for street sprinkling. It will of course meet with a hardship to those concerned, and perhaps serious objections, but it is a matter of too vast importance to allow water for such purposes, when such uses will endanger property in case of a large conflagration. The over-anxiety during the heated spell to have the streets sprinkled, to cool off the air, the distance to draw the water from the lakes will loom up, but just at such times buildings are as a tinder-box with no water to depend upon, as on several days during the drouth; and as for the motors, other factors are in the market for same purpose. You will note that, notwithstanding the increased pumpage during the heated spell, the average water pumped for each taker was 26 gallons less than the previous year, on account of the increase of meters, and with your instructions carried out, not to allow any more sprinkling done without a water meter, the consumption will be lessened and held in check, justice done to all, and water at command.

REPAIRS.

The question has been raised that it was impossible that our repairs are not more than given in the Secretary's Report, and that we endeavored to have the construction fund appear large at the expense of the operating and repair fund. It is true the repair expense looks small, but nevertheless it is a fact. During the twelve years of our existence we have had only eight leaks to repair, and generally repaired in a day. Great care was taken by the committee in the inspection when the original mains were laid by contractor, and only the best of pipe used; and every foot of pipe that has been laid since, and joints caulked, has had our personal supervision, if it required all day and all night; it was a hard task, but the city is the gainer, and the repairs prove it. There is not a city that has less repairs than ours, and for that we are criticised. The repairs would be still less if the hydrants would not be used by the sprinkling carts. The past year the repairs were only $353.05. We had one leak, a sand-hole in the main pipe; the cost to repair was $9.85. Our repairs thus far since the construction are $2,538.63 for the twelve years. For the benefit of doubt that may be raised, I have taken the pains to look up carefully the official as well as the printed records showing the original cost of the plant and the additions and improvements made since.

The original cost of construction up to April 15, 1884, when works were placed in charge of the Water Commissioners, exclusive of wells, new mains and service connections built and laid previous to above period, was	$102,542.29
Wells and suction, etc.	32,462.73
Additional coal house, July 9, 1886	575.60
New water mains	69,763.45
Filling, grading, sodding, seeding grounds and planting trees	1,139.68
Sidewalks, gutters and sewer drains in front of station and from fountains	825.24
Drinking and jet fountains	929.52
Service connections	25,925.70
Steam drum and covering	543.92
Furniture, map, papering, painting, counter, safe, etc., in office	519.14

Reserve basin	$6,004.36
Mechanical stoker	1,194.31
Resetting and repairing boilers	512.96
Water tower	8,796.91
Meters, boxes, labor and material	21,733.10
Air chamber	4,385.92
Air chamber on pumps	929.18
Pipe and storage building	3,819.03
Trench, Van Duzen & Nye, pumps	259.00
Rent of pipe yard opposite works	245.44
Painting station	216.12
Entertaining visiting committees	37.75
Inspection by commissioners	45.00
New tapping machine	100.00
Macadamizing Gorham street	312.42
New steam whistle	36.85
Total	$283,855.62

The total construction to date is $284,363.65, leaving a balance of $508.03, which might be placed under operating and repair expenses, but really ought to be placed under expense account. Of the above, the resetting and repairing of boilers should, it seems, be placed under repairs; but as this was caused by the removal of the mechanical stoker, requiring new partition walls and boiler front, etc., it is a proper charge to construction. The painting, entertaining, inspection, new tapping machine and new steam whistle should come under the head of expense account, certainly not under operating. The proper operating expenditure is what is required to pump the water and to manage the plant. The pumping station being surrounded by a park, requiring continuous care in cutting the grass, cleaning the gutters, repairing the walks on four sides and replacing same, and shoveling of snow in winter (these items are all added to the operating expenses), naturally makes our operation higher than other cities not so situated.

The question may be raised that the figures given above are not correct and that they might be colored. To answer such statements, I will state that the laying of the original $11\frac{1}{2}$ miles of main by the contractor, including pipe, hydrants, valves and wooden valve boxes, cost $56,615.28, or $93\frac{14568}{60724}$ cents

per mile; this includes sizes from 4 to 16 inch on continuous stretch. We have laid since the original construction $16\frac{4}{6}$ miles of mains, divided between 10 years, and short runs, mostly low lands and treacherous soil, including pipe, specials, hydrants, valves, and using iron valve boxes, being obliged to insert branches which were omitted by the contractor; also divided the larger districts into smaller, with additional valves, to inconvenience less water-takers in case we are obliged to cut off water for repairs, at a cost of \$69,763.45, or $76\frac{87097}{90648}$ cents per mile; sizes range from 4 to 8 inches.

The average cost of the ten wells, including 4,983 feet of suction pipe, ranging from 8 to 16 inch, was \$3,246.27$\frac{3}{10}$.

The average cost of the service connections, varying in lengths from 19 to 300 feet, and in sizes from $\frac{1}{2}$ to $2\frac{1}{2}$ inch, was $52\frac{2}{3}$ cents per foot.

The average cost of the water meters ranging from $\frac{5}{8}$ to 3-inch, including the labor and material in placing the same on services in 1888–9, was \$27.33$\frac{3}{5}$.

WATER RATES.

Last spring criticism was made about our high water rates, and same has occurred oft and anon. For the benefit of our citizens who may have been misled by these assertions and statements, I have prepared a table of 44 cities, ranging from a population of 34,871 to 2,000,000, of the meter and schedule rates charged in those cities, and compare our city with those, having only a population of 14,000. These were the only cities I could reach showing the schedule and meter rates. To those we have added 22 cities ranging from 14,000 to 33,220 population, which give only the meter rates, as we were unable to find their schedule rates. These 66 cities show a combined population of 7,134,841. Number of takers 859,740 (which would average to a family of 5 to each taker, 4,298,700 users), and number of meters in use in above cities 75,169, or only 5 per cent., proving that the meter system is only in its infancy.

TABLE OF COMPARISON.

CITY.	Population.	No. of takers.	No. of meters in use.	Meter rates per 1,000 gal.	Minimum.	Schedule Rates. Domestic.	Schedule Rates. Water closet.	Schedule Rates. Bath tub.	Schedule Rates. Basin.	Total per annum.
Chicago, Ill.	2,000,000	200,000	4,326	8 to 10	....	$6 00	$3 00	$3 00	$1 00	$13 00
Boston, Mass.	558,400	86,662	4,245	10⅔ to 18⅔	....	7 00	5 00	5 00	5 00	22 00
St. Louis, Mo.	544,569	47,495	3,750	10 to 30	....	6 00	5 00	3 00	Free	14 00
Cincinnati, Ohio	300,000	43,000	1,650	9 to 15	....	6 00	3 00	5 00	1 00	15 00
San Francisco, Cal.	298,992	28,674	15,500	21⅓ to 40	....	8 00	5 00	5 00	1 00	19 00
Milwaukee, Wis	250,000	25,900	9,008	4⅔ to 20	....	6 00	2 00	3 00	1 00	12 00
Louisville, Ky	200,000	16,300	792	6 to 15	....	6 00	4 00	3 00	1 00	14 00
Jersey City, N. J.	163,003	15,908	400	10 to 20	....	5 70	2 00	3 00	Free	10 70
Providence, R. I.	150,000	17,302	10,908	15 to 20	$10 00	6 00	5 00	5 00	2 00	18 00
St. Paul, Minn.	150,000	13,039	713	10 to 20	12 00	8 00	4 00	3 20	Free	15 20
Rochester, N. Y.	145,700	26,167	3,300	10 to 20	5 00	6 00	2 00	2 00	Free	10 00
Kansas City, Mo.	132,716	12,814	2,700	9 to 25	....	6 75	4 00	4 00	Free	14 75
Indianapolis, Ind.	115,000	3,600	450	5 to 25	20 00	5 00	3 00	3 00	1 00	12 00
Syracuse, N. Y.	105,000	3,578	976	6 to 25	10 00	8 00	5 00	4 00	1 00	18 00
Grand Rapids, Mich.	90,000	6,200	496	4⅔ to 20	....	8 00	4 00	3 50	2 50	18 00
Richmond, Va	90,000	12,923	300	7 to 15	....	6 00	3 00	3 00	1 00	13 00
New Haven, Conn.	90,000	12,000	140	9 to 30	10 00	6 00	3 00	3 00	Free	12 00
Fall River, Mass.	87,773	5,793	3,975	10 to 28	8 00	5 00	5 00	5 00	1 00	16 00
Lowell, Mass.	87,000	10,000	2,300	14⅔ to 18⅔	7 00	6 00	4 00	3 00	Free	13 00
Dayton, Ohio	76,000	6,200	150	6 to 10	10 00	6 00	2 50	2 00	2 00	12 50
Cambridge, Mass.	70,028	20,926	287	10 to 20	....	5 00	6 00	6 00	Free	17 00
Hartford, Conn.	62,000	12,000	435	7½ to 30	....	6 00	1 00	3 00	1 00	11 00
Troy, N. Y	60,956	7,602	237	5 to 10	....	6 00	2 00	3 00	Free	11 00
Saginaw, Mich	60,000	36,000	234	13 to 25	....	7 00	2 50	3 00	1 00	13 50
Trenton, N. J.	57,458	56,813	125	8 to 12	....	6 00	3 00	3 00	1 00	13 00

TABLE OF COMPARISON — *Continued.*

City.	Population.	No. of takers.	No. of meters in use.	Meter rates per 1,000 gal.	Minimum.	Schedule Rates. Domestic.	Schedule Rates. Water closet.	Schedule Rates. Bath tub.	Schedule Rates. Basin.	Total per annum.
Birmingham, Ala.	50,000	4,000	500	$6\frac{2}{3}$ to 30	....	$6 00	$3 00	$3 00	$1 00	$13 00
Covington, Ky.	50,000	4,000	486	8 to 20	$10 00	6 00	3 00	3 00	Free	12 00
Springfield, Mass.	49,299	6,663	1,422	7 to 30	....	8 00	4 00	4 00	Free	16 00
Oakland, Cal.	48,682	4,681	160	30 to 55	....	8 00	5 00	4 00	1 00	18 00
Lawrence, Mass.	44,654	5,128	2,001	8 to 20	....	5 00	4 00	3 00	2 00	14 00
Seattle, Wash.	42,837	4,078	150	10 to 25	....	8 00	4 00	4 00	1 00	17 00
Hoboken, N. J.	43,648	4,184	5,530	$15\frac{2}{3}$ to $23\frac{1}{3}$	....	6 00	3 00	3 00	1 00	13 00
Peoria, Ill.	41,024	4,006	1,250	6 to 50	....	5 00	3 00	3 00	Free	11 00
Holyoke, Mass.	40,000	2,975	177	5 to 15	....	6 00	3 00	3 00	1 00	13 00
Sioux City, Iowa	40,000	3,200	160	11 to 25	12 00	6 00	4 00	4 00	1 00	15 00
Binghamton, N. Y.	38,000	5,500	395	6 to 25	10 00	6 00	3 00	3 00	Free	12 00
Portland, Me.	36,425	3,517	329	20 to $33\frac{1}{3}$	....	10 00	6 00	5 00	Free	21 00
Fort Wayne, Ind.	35,393	2,255	320	$6\frac{1}{2}$ to 10	....	7 00	4 00	3 00	1 00	15 00
Elmira, N. Y.	35,000	3,000	325	10 to 50	10 80	8 00	4 00	3 00	3 00	18 00
Tacoma, Wash.	36,000	3,473	234	13 to 25	....	8 00	4 00	4 00	2 00	18 00
Yonkers, N. Y.	35,000	3,291	3,257	$5\frac{1}{3}$ to $26\frac{4}{5}$	4 00	6 00	3 00	3 00	1 00	13 00
Quincy, Ill.	35,000	1,800	519	$14\frac{1}{4}$ to 45	15 00	5 00	5 00	5 00	Free	15 00
Norfolk, Va.	34,871	3,298	120	20 to 40	....	6 00	3 00	3 00	1 00	13 00
Madison, Wis.	14,000	1,820	795	$6\frac{2}{3}$ to $26\frac{2}{3}$	5 00	5 00	2 50	3 00	Free	10 50
Youngstown, Ohio	33,220	3,155	200	8 to 20	....	....	....	....	....	....
Bay City, Mich.	33,000	1,817	395	5 to 10	6 00	....	....	....	....	....
McKeesport, Pa.	30,000	3,000	350	4 to 30	....	....	....	....	....	....
Pawtucket, R. I.	30,000	6,386	4,397	6 to 30	10 00	....	....	....	....	....
Chattanooga, Tenn.	29,100	3,007	1,050	8 to 40	....	....	....	....	....	....
Waterbury, Conn.	28,646	3,684	188	5 to 30	....	....	....	....	....	....

Akron, Ohio	27,601	2,645	125	8 to 16	....	....	....	....	....	....
Newton, Mass.	27,300	5,100	3,600	12 to 35	10 00	....	....	....	....	....
Davenport, Iowa	26,872	2,631	310	20¼ to 40	....	....	....	....	....	....
Taunton, Mass.	25,448	3,635	1,230	9 to 25	10 00	....	....	....	....	....
Lexington, Ky	25,000	1,191	986	15 to 25	6 00	....	....	....	....	....
Montgomery, Ala	25,000	2,400	800	12½ to 25	13 00	....	....	....	....	....
Woonsocket, R. I.	25,000	1,612	1,406	10 to 30	10 00	....	....	....	....	....
Bayonne, N. J	23,000	3,000	1,500	13½ to 23⅓	....	....	....	....	....	....
Racine, Wis	23,000	2,968	284	6 to 30	10 00	....	....	....	....	....
Macon, Ga.	22,746	2,486	213	15 to 30	....	....	....	....	....	....
Fitchburg, Mass.	22,037	2,684	1,267	5 to 35	....	....	....	....	....	....
Council Bluffs, Iowa	21,474	2,074	210	15 to 35	....	....	....	....	....	....
Leavenworth, Kan	19,768	1,869	350	20 to 50	....	....	....	....	....	....
Jacksonville, Fla.	17,201	1,698	480	6⅔ to 16	....	....	....	....	....	....
Freeport, Ill	15,000	933	206	10 to 50	6 00	....	....	....	....	....
Madison, Wis	14,000	1,820	795	6⅔ to 26⅔	5 00	....	....	....	....	....

By comparing the above cities with our city you will see that there is only one city (Rochester, N. Y.) that has a less schedule rate than ours, and there the population is ten times greater. A large city ought certainly be more able to sell water cheaper than a small city. Let us now look to the meter rates. In the first place you will note that all have a sliding scale, and again that there are only eleven cities that have adopted the general meter system, and must be compared with each other. The cities are, viz.:

San Francisco, Cal.	Rate	$21\frac{1}{3}$ to 40c.	per	1,000 galls.	Minimum	$10.00
Providence, R. I.	"	15 to 20	"	"	"	10.00
Fall River, Mass.	"	10 to 28	"	"	"	16.00
Hoboken, N. J.	"	$15\frac{2}{3}$ to $23\frac{1}{3}$	"	"	"	13.00
Yonkers, N. Y.	"	$5\frac{1}{3}$ to $26\frac{4}{5}$	"	"	"	13.00
Pawtucket, R. I.	"	6 to 30	"	"	"	10.00
Newton, Mass.	"	12 to 35	"	"	"	10.00
Woonsocket, R. I.	"	10 to 30	"	"	"	10.00
Bayonne, N. Y.	"	$13\frac{1}{2}$ to $23\frac{1}{3}$	"	"	"	——
Fitchburg. Mass.	"	5 to 35	"	"	"	——
Madison, Wis.	"	$6\frac{2}{3}$ to $26\frac{2}{3}$	"	"	"	5.00

All the other cities have only meters for manufactories and large consumers, and of those there are only thirteen that sell water less than we do with only one manufacturing establishment. For $5.00 per annum we furnish 18,750 gallons of water, which means over one and a half barrels a day; certainly sufficient for any ordinary family without stinting themselves. *But when a patron will insist upon wasting the water and thereby create a large water bill, the rates would be too high at one cent a thousand gallons,* and even then he will raise the cry the water rates are too high. Everything is all wrong; it must be reformed. The meters are placed to check the unnecessary waste, meters furnished free, and lowest rate given, as above table shows, which was taken from the compilation of latest returns of Water Works Statistics of 1894, of 194 cities and towns, and certainly proves our assertion that our schedule and meter rates are of the lowest.

METERS.

We are gradually drawing to the "general meter system" as the funds allow. Your honorable body has only been able to set aside a small amount to the purchase of the meters, on account of the city furnishing them free to the patrons, there being a shortage of funds. During the year we added 122, which makes to date, September 30, 1895, 795 meters in use, and by the 1st of January, 1895, there will be 158 more connected, total 953, being over 50 per cent. of our takers, and by the 1st of July, 1895, we expect to have the number increased to 1,100, following close your instructions to place them as fast as possible, when spring opens, on all services rated $8.00 per annum and over, and on all services where they desire to sprinkle, and then commence on the lesser rate.

During the period from the construction until 1888 our average pumpage for each taker was from 720 to 781 gallons; during 1888, after we had added 130 meters, the falling off during the last three months of the year brought the average to each taker to 640 gallons, and since then it dropped to 390 in 1893, but rose to 409 in 1894 on account of so much sprinkling being done without meters during the heated spell. What would the city have done without the meters? With an artesian well supply, which is always limited, could we have guarded our water? the grandest and purest furnished as a public supply. Other cities as a rule add pumping machinery continuously, expense upon expense, to keep up with the careless waste of their patrons. In 1886, without meters, we pumped, having 876 takers, 648,355 gallons per day, or 740 gallons for each taker; whereas the past year, with half the consumers under the meter system, having 1,820 takers, being 924 more than in 1886, we pumped 745,224 gallons, or only 96,869 gallons more per day, and only an average of 409 gallons for each taker per day, including the great waste during the heated term, street sprinkling, flushing mains, fountains, fires,— in fact all uses, free to city included. All this saving of our water has been accomplished by only expending thus far $21,733.10, thereby saved a lake connection which would

have doubled the above expenditure. With the general meter system, street sprinklers and water motors cut off, the lowering of pumps and air lift system adopted, we will be in splendid condition to meet any demand called for.

RECORD OF AMOUNT OF WATER PUMPED PER ANNUM FROM FEBRUARY 21, 1884, TO OCTOBER 1, 1894.

YEAR.	Amount gallons pumped.	Population.	No. of Takers.	Average each Taker.
		Census 1880.		
*Feb. 21, 1883 to Oct. 1, 1884	34,728,224	11,325	307	—
Oct. 1, 1884 to Oct. 1, 1885	199,333,840	11,325	699	781
		Census 1885.		
Oct. 1, 1885 to Oct. 1, 1886	236,649,850	12,063	876	740
Oct. 1, 1886 to Oct. 1, 1887	261,308,160	12,063	980	720
Oct. 1, 1887 to Oct. 1, 1888	257,682,300	12,063	1,099	640
Oct. 1, 1888 to Oct. 1, 1889	195,450,770	12,063	1,229	420
Oct. 1, 1889 to Oct. 1, 1890	190,810,910	12,063	1,355	384
		Census 1890.		
Oct. 1, 1890 to Oct. 1, 1891	197,889,450	13,246	1,405	314
Oct. 1, 1891 to Oct. 1, 1892	236,035,800	13,246	1,554	413
Oct. 1, 1892 to Oct. 1, 1893	268,246,300	13,246	1,701	390
Oct. 1, 1893 to Oct. 1, 1894	272,006,950	13,246	1,820	409

*Commenced keeping record February 21, 1884.

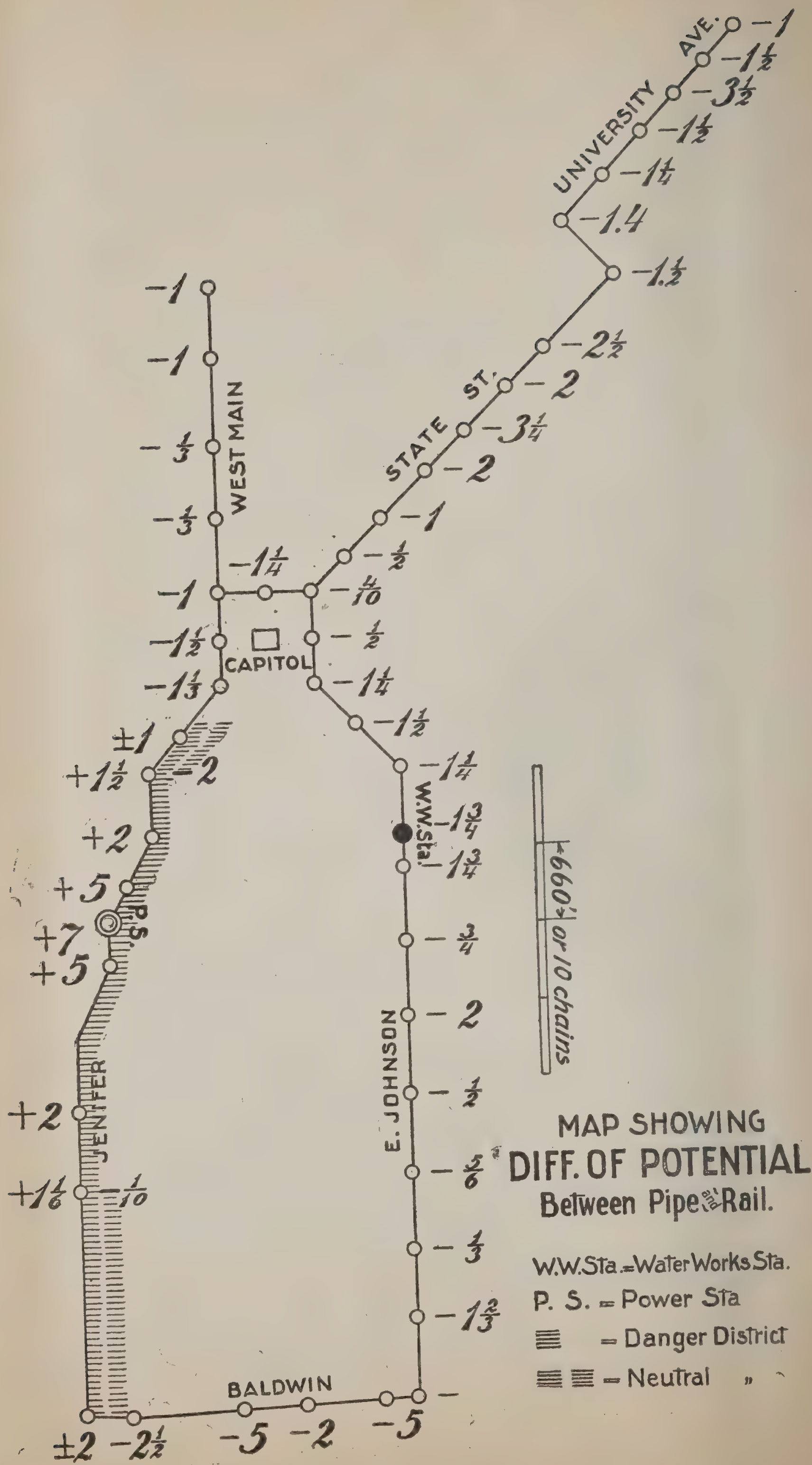
ELECTROLYSIS.

The corrosion of iron pipes by the action of electric railway currents, creating wide-spread attention, showing such action, as on the water mains in Milwaukee, that at two feet from the power house a six-inch water main was so badly corroded after the electric railway had been in operation for four years, rendering it entirely useless. When taken out of the ground it was so soft in places that a cane could easily be poked through it. In Zanesville, Ohio, a four-inch water main was completely perforated in two years; the neighboring pipes were also affected, some lasting only six months. Water mains were also affected more or less in Brooklyn, Philadelphia, Boston, Indianapolis, Columbus, O., Peoria, Ill., Los Angeles, Cal., etc. This naturally attracted our attention, but

we found no corrosion when tapping the mains or cutting the main to place branches for new mains. During the month of May, 1894, Paul Biefeld and Fred. D. Silber, graduates of our University, made an investigation under the direction of D. C. Jackson, C. E., Professor of Electrical Engineering University of Wisconsin, of the eight-inch water main in front of the electric power house, a space of 16 feet being uncovered, having 2,412 square inches of metal facing the rail, this being the danger district. The main was uncovered again 30 feet from the former opening. The main lays about 6 feet below the street level, 9 feet from the rails, and is surrounded by a sandy soil. The water main had been subjected to electrolytic action for nearly two years, and showed a covering of a reddish layer on top and on the side towards the rail, while the other side was unaffected. The main 30 feet away was perfectly clean, showing that the action must have been electrolytic, though small. The only samples of earth that showed any traces of alkalinity were those taken from under the rail. This investigation showed, up to date, a barely appreciable action, and that high-pressure differences do not necessarily imply a high degree of action.

The summing up of their report is as follows: "From this investigation it will be seen that the reduction of the life of the pipes in Madison, Wis., due to electrolysis would be practically no greater than that due to natural oxidation, if we suppose the corrosion to be evenly distributed. The present indications show that one connection between the rails and the pipe system opposite the power house, costing about $15, would prevent any serious action.

This is a great relief, judging from what other cities have suffered. The connection we will add early in the spring. The map on the page following shows the course of the electric street railway line and differences of potentials between the water main and rails, the danger and the neutral district. We are indebted to the above gentlemen for the kind information and assistance rendered in this investigation.


UNIVERSITY AVE.
STATE ST.
WEST MAIN
CAPITOL
W.W.Sta.
P.S.
JENIFER
E. JOHNSON
BALDWIN
660' or 10 chains
MAP SHOWING
DIFF. OF POTENTIAL
Between Pipe and Rail.
W.W.Sta. = Water Works Sta.
P. S. = Power Sta
= Danger District
= Neutral "

PUMPAGE.

Monthly record of the amount of water pumped and coal consumed during the year.

Prepared by Chief Engineer Peter Gauer.

MONTHS.	Gallons of water pumped.	Revolution of large engine.	Revolution of small engine.	Average steam pressure.	Average water pressure.	Average vacuum in inches.	Pounds of coal consumed.	Ashes in lbs.	Net combustibles.	Duties in foot lbs. per 100 lbs. net combustibles.
Oct. 1893	18,094,500	197,000	1,108,000	70	82	17	101,200	16,192	85,008	37,628,200
Nov. 1893	18,409,700	121,000	1,259,000	70	82	17	100,000	16,000	84,000	39,055,000
Dec. 1893	20,356,750	104,000	1,445,500	70	82	19	119,600	19,136	100,464	36,419,000
Jan. 1894	19,805,250	42,000	1,510,500	70	82	19	126,000	20,160	105,840	33,712,000
Feb. 1894	19,723,000	438,000	799,000	70	82	19	129,200	20,672	108,528	32,787,500
Mar. 1894	19,187,500	....	1,535,000	70	82	19	97,000	15,520	81,480	42,138,000
April, 1894	18,150,000	....	1,452,000	70	82	18	91,800	15,640	76,160	42,693,000
May, 1894	20,624,500	271,000	1,173,000	70	82	20	105,800	16,908	88,892	41,559,500
June, 1894	26,539,250	403,500	1,416,500	70	82	24	122,800	19,648	103,152	45,157,500
July, 1894	34,012,000	1,546,000	....	70	75	24	131,400	21,024	110,376	53,136,900
Aug. 1894	31,118,500	1,417,500	....	70	75	24	143,200	22,912	120,288	44,629,000
Sept. 1894	24,992,000	1,136,000	....	70	82	22	124,800	19,968	104,832	42,944,300
	272,006,950	5,676,000	11,698,500	70	81	21	1,393,800	223,780	1,169,020	Av. 40,098,221

It will be seen that the greatest pumpage was in the months of July and August. The average pumpage for each taker was in July 602½ gallons, in August 553⅓ gallons. and the other ten months 194 gallons; for the twelve months 406 gallons.

RECORDS OF FIRE DURING THE YEAR.

Date.	Time.	Duration.	Gallons of water pumped for fire.	Pressure at station in lbs.	Remarks.
Oct. 30, 1893.	10:15 p. m.	10 m.	2,000	95	
Nov. 15, 1893.	9:45 p. m.	....	......	....	False alarm.
Nov. 16, 1893.	....	....	None.	......	Fire at Edgewood.
Nov. 29, 1893.	5:25 p. m.	....	......	......	False alarm.
Dec. 18, 1893.	5:10 p. m.	....	......	.....	False alarm.
Dec. 19, 1893.	7:20 a. m.	....	......	......	False alarm.
Jan. 13, 1894.	12:20 a. m.	....	.....	......	False alarm. Box 41.
Jan. 17, 1894.	12:40 a. m.	20 m.	10,000	80–95	Box 16.
Jan. 22, 1894.	6:20 a. m.	10 m.	2,000	80–85	Box 26.
Jan. 24, 1894.	12:05 p. m.	1 h. 45 m.	42,000	80–85	Box 45.
Jan. 24, 1894.	10:20 p. m.	1 h. 25 m.	34,000	70–80	Box 14.
Jan. 28, 1894.	9:45 a. m.	50 m.	20,000	80–100	Box 51.
Jan. 29, 1894.	5:00 p. m.	10 m.	4,000	80–85	Box 51.
Feb. 9, 1894.	1:35 a. m.	10 m.	3,000	80–85	Box 41.
Feb. 11, 1894.	1:10 p. m.	....	None.	......	Box 45.
Feb. 16, 1894.	10:50 a. m.	....	None.	......	Box 41.
Mar. 9, 1894.	9:00 a. m.	15 m.	6,500	80–95	Box 51.
Mar. 10, 1894.	1:55 p. m.	....	None.	......	Box 61.
Mar. 14, 1894.	9:15 a. m.	....	None.	......	Box 54.
Mar. 21, 1894.	10:55 p. m.	....	None.	......	Box 53.
Mar. 24, 1894.	8:10 p. m.	....	None.	.....	Box 18.
Mar. 27, 1894.	6:25 p. m.	45 m.	33,000	80–95	Box 28.
Mar. 30, 1894.	10:25 p. m.	5 m.	1,200	80–90	Box 41.
April 1, 1894.	12:45 p. m.	....	None.	......	Box 14.
April 1, 1894.	9:15 p. m.	....	None.	......	Box 43.
April 2, 1894.	5:25 p. m.	25 m.	6,000	85–90	Box 64.
April 3, 1894.	5:15 p. m.	....	None.	......	Box 16.
April 11, 1894.	4:25 p. m.	....	......	......	Box 18.
April 15, 1894.	12:05 a. m.	....	None.	......	Box 61.
April 20, 1894.	7:25 p. m.	....	None.	......	Box 62.
April 26, 1894.	1:10 a. m.	10 m.	3,000	80–95	Box 28.
May 2, 1894.	9:50 p. m.	....	......	......	Box 21.
May 3, 1894.	1:40 a. m.	25 m.	10,000	90–100	Box 62.
May 3, 1894.	2:00 a. m.	15 m.	6,000	90–100	Box 26.
May 3, 1894.	8:10 a. m.	25 m.	10,000	76–81	Box 61.
May 16, 1894.	5:20 p. m.	....	None.	......	Box 62.
May 18, 1894.	8:10 a. m.	....	None.	...	Box 21.
June 1, 1894.	3:30 a. m.	10 m.	2,000	90–100	Box 31.
June 3, 1894.	3:00 a. m.	5 m.	1,000	90–95	Box 28.
June 16, 1894.	5:40 a. m.	20 m.	4,000	80–90	Box 64.
June 27, 1894.	11:25 a. m.	....	None.	......	Box 45.
July 5, 1894.	12:25 p. m.	....	None.	......	Box 51.
Aug. 9, 1894.	4:05 p. m.	....	None.	......	Box 54.
Sept. 5, 1894.	2:00 p. m.	....	None.	......	Box 41.
Sept. 7, 1894.	1:15 p. m.	....	None.	......	Box 51.
Sept. 7, 1894.	6:55 a. m.	15 m.	3,000	80–85	Box 43.
Sept. 8, 1894.	12:55 p. m.	....	None.	......	Box 43.

WATER PERMITS.

During the year ending September 30, 1894, we issued 119 original and 69 extension permits, making total takers to date, 1,820, which, rated at five to a family, means 9,100 persons being supplied with city water out of a population of 14,000.

WATER RENTS.

The annual revenue of the 1,820 water-takers was $18,560.44; from water permits, $238, a total of $18,798.44; an increase over last year of $2,298.74. The average for each taker was $10.20.

OPERATING EXPENSES.

The operating expenses for the year ending September 30, 1894, was $11,626.01. We used the authracite pea coal, contracted for with C. F. Cooley, he being the lowest bidder, at $5.27 per ton. The receipts of the water rents being $18,560.44, leaving a balance of $6,934.43 ($1,191.52 more than in 1893), which was placed in the construction fund.

CONSTRUCTION EXPENSES.

The construction, meters, extensions, improvements, and repairs of $353.05, for year ending September 30, 1894, was $13,280.74.

SERVICE CONNECTIONS.

During the past year we again did our own laying of service connections instead of by contract. We find that it is better and cheaper for the city to do its own tapping, and there is less annoyance and trouble.

During the year we laid 3,268 feet of services, which brings the number of feet of services to curb-stone to 50,193, or $9\frac{1673}{5280}$ miles.

The following table shows on what streets services were placed the past year; size and number of feet on each street, and the total:

TABLE SHOWING SERVICE PIPE LAID.

Street or Avenue.	$\frac{5}{8}$ inch.	$\frac{3}{4}$ inch.	1 inch.	Total.
Baldwin	58			58
Basset	48			48
Blair	96			96
Blount	19			19
Broom	124			124
Butler	47			47
Carroll	48			48
Charter	29			29
Clymer	57			57
Dayton	318			318
Doty	125			125
Fairchild	19			19
Francis		29		29
Gorham	58	67		125
Hancock	346			346
Hamilton	19			19
Henry	32			32
Johnson	230			230
Jenifer	177	29		206
Langdon		19	29	48
Lake	96		19	115
Livingston	65			65
Main	154			154
Mendota Court	8			8
Mifflin	134			134
Murray	29			29
Patterson	135			135
Park	125			125
Pinckney	48			48
Spaight	125			125
University Ave	104	23		127
Washington Ave	231		28	259
Wisconsin Ave		45		45
Wilson	49			49
Williamson	115			115
Total	3,268	212	76	3,556

Nineteen services were laid previous to macadamizing the street to prevent tearing up afterwards.

HYDRANTS.

The hydrants require our continuous care and watching during a cold spell in winter, and especially those used by the sprinkling carts. In the first place they cannot open the hydrant full when filling their tank; and in the second place, sprinkling is carried on until late in the season, the earth surrounding it is saturated with water, and when the cold weather

sets in, the frost will go deeper and more rapidly than otherwise is the case and liable to be caught. These hydrants are in the most dangerous part of the city in case of a large conflagration. Something ought certainly to be done; either give them independent hydrants or let them draw the water from the lakes. In several instances we also found, where hydrants were causing us trouble, that in one case the root of a tree had grown into the waste at the bottom, and the other instances where the soil was fairly baked on the hydrant, obstructing the waste, caused by the roots of the trees absorbing the moisture of the soil surrounding the same.

RETROSPECT.

We have now passed the twelfth year of the construction of our Water Works and entered the thirteenth of its existence, and it is with pride and satisfaction we can look back to these years of the steady progress made. The Water Works was the event of the growth of our city; the population had remained for years at a stand still, but soon after their construction we began to grow. The plant has steadily increased until we have an investment of $284,463.65. The net water receipts since construction are $46,409.60 (nearly sufficient to cover the expense of service connections and the water meters), leaving a cash outlay of only $238,054.05. Our original bonded indebtedness of $76,000 has been reduced to $15,500, and by the 1st of April, 1895, it will be reduced to $8,000. During the past year no new mains have been laid as per your instructions postponed to the coming year, to complete the work already begun and investing balance in water meters. This leaves our length of mains as last year, 28⅔ miles. We have already calls on hand for over a mile of mains which we will lay the coming season. We have endeavored to conduct the management of the Water Works, intrusted to us by your honorable body, in a business like manner, impartial and fearless, with the interest of the city in view, in matters of doubt favorable to the patron, which the results prove, and shall con-

tinue to conduct the same hereafter as long as you desire to entrust us with the management; and, in

CONCLUSION,

I wish to express my gratitude to each member of the Board for the ready assistance, valuable counsel and confidence reposed. The city is certainly indebted to your honorable body for the care, painstaking, zeal and diligence you have shown to carry out the duties intrusted for the success of the Madison City Water Works. I desire, also, to express my satisfaction to the Meter Inspector, Secretary, Chief Engineer and his Assistants, Firemen and Laborers for the ever willing, prompt and faithful discharge of their respective duties.

Respectfully submitted,

JOHN B. HEIM,

Superintendent.

SUMMARY OF STATISTICS.

In accordance with recommendations of American and New England Water Works Association.

REPORT OF 1893 AND 1894.

CITY WATER WORKS, MADISON, DANE COUNTY, WISCONSIN.

Population by census of 1890	13,246.
Date of construction	1881–82.
By whom owned	City of Madison.
Source of supply	10 Artesian wells.
Mode of supply	Direct pressure.
Pumping machinery	Reynolds-Corliss engines with Knowles pumps combined.
Description of coal	Anthracite pea.
Coal consumed for the year in pounds	1,393,800.
Coal consumed for the year in pounds net combustible	1,169,020.
Average static head against which pumps work	197.
Average dynamic head against which pumps work	$218\frac{7}{10}$.
Number of gallons pumped per pound of coal	195.
Number of gallons raised 100 feet per pound of coal	$425\frac{1}{10}$.
Duty in foot pounds per 100 pounds of coal, making no deductions for starting, banking fires, heating building or anything else	35,424,000.
Cost of pumping figured on total maintenance per million gallons raised against average	43.1.
Per million gallons raised one foot high (dynamic)	$10\frac{97}{100}$

Consumption.

Total number of gallons pumped for the year	272,006,950.
Average daily consumption	745,224.
Number of takers	1,820.
Average gallons pumped per day each taker	409.
Average gallons pumped per day each inhabitant	$53\frac{1}{4}$.

Distribution.

Kind of pipe	Cast iron 3 to 16 inch.
Total miles of mains	$28\frac{3861}{5280}$.
Total hydrants	146.
Total valves	175.
Total miles of services (lead)	$9\frac{1673}{5280}$.
Total feet of cast iron suction pipe	4,983.

Analysis of Water.

Potassium sulphate	0.237.
Sodium sulphate	0.286.
Sodium phosphate	Trace.
Bi-carbonate of soda	1.094.
Bi-carbonate of lime	15.234.
Bi-carbonate of magnesia	12.984.
Bi-carbonate of iron	0.214.
Sexqui-oxide of Aluminum	Trace.
Silica	0.414.
Sodium chloride	0.292.
Organic matter	None.
Total solid contents per gallon	30.755.

FIRE ALARM.

Signals of the fire alarm from bells and whistle are as follows, and is same number of blows as number of box:

SIGNAL BOXES.

Box.	*Location.*
3	Fuller & Johnson W'ks, 3 blows.
	FIRST WARD.
12	Wisconsin Av. and Gorham st.
14	State, Gilman and Broom.
16	Mifflin and Broom.
18	State and Fairchild.
	SECOND WARD.
21	Washington Av. and Canal st.
23	Dickinson and Dayton.
24	Johnson and Few.
26	Johnson and Patterson.
28	Pinckney, Mifflin and Hamilton.
	THIRD WARD.
31	Pinckney and Wilson.
34	Wilson and Blair.

FOURTH WARD.

Box.	*Location.*
41	Main, Carroll and Hamilton.
43	Wilson and Broom.
45	West Main, at C., M. & St. P. tracks.
46	Washington Av. and Brooks.
	FIFTH WARD.
51	University Av. and Lake.
53	West Johnson and Park.
54	University Av. and Mary.
	SIXTH WARD.
61	Main and Blount.
62	Jenifer and Brearly.
64	Jenifer and Baldwin.

INSTRUCTIONS FOR OPERATING FIRE ALARM BOX.

Key can be had at any one of the nearest houses to the boxes.

Unlock the door, pull the hook all the way down and let go. Do not jerk the hook down and up, but pull it down steadily as far as you can. Wait at the box until the department arrives, and inform them where the fire is.

The tower bell will strike the number of the box pulled. Thus — for box 34, the bell at the tower will strike and the whistle will blow - - - - - - - three blows, a short pause, then four blows; after which a longer pause. The above will be repeated three additional times. The whistle will give the alarm twice.

Each key is registered. Do not attempt to remove the key; it will be released and returned when the fire is out.

Signals for use of department only are as follows:

Fire out — one tap.

More pressure — two taps.

Second alarm — two taps repeated.

RULES FOR THE WATER METERS.

The following rules have been adopted by the Board of Water Commissioners, to govern the use of water meters:

SECTION 1. All services which may hereafter be connected with the city Water Works system shall be connected with the meter furnished by the city, if such services shall include sewerage, cesspool or sprinkling of streets or lawns. And all other services and connection shall be so placed that meters can be attached whenever the Board of Water Commissioners may direct it to be done. The water rent wherefore such meter shall have been placed shall be according to the measurement of the meter used. All water meters shall be placed inside of buildings. From and after July 1, 1894, water meters will be placed on all premises that now have the service connection where the present rate of water rent equals or exceeds eight dollars ($8) per annum, and in connection with all services used for sprinkling purposes and where yard hydrants are used, and also in connection with such other services where it shall be discovered that there is a constant flow of water, or no meter being used, or as the Board of Water Commissioners may from time to time deem proper and necessary. All new water services hereafter made for domestic purposes only shall be so constructed and placed that meters can be readily attached whenever the Board of Water Commissioners may order the same to be done.

SECTION 2. The City of Madison will furnish all meters for one building free to consumers. All meters must be placed by a licensed plumber at expense of property owners, and as near as possible to where service pipe enters building. The plumber doing the work must flush pipe thoroughly before connecting meter. The city will repair all meters that are clogged, and if lead chips are found to be the cause, a fine of $1.00 will be collected from the plumber doing the work for each and every job so found before issuing another permit to said plumber. No water meter shall be removed or disturbed without first having obtained permission from the Superintendent of the Water Works.

SECTION 3. A check and waste shall be placed between the shut-off cock and meter within one foot of the meter. All meters shall be so located and placed as to afford easy access thereto, and so that they can be easily examined and read. In all cases where meters have been ordered and have

been supplied, no water from the City Water Works shall be taken, received or supplied to the building for which the same was constructed and intended except that which shall pass through and be registered by such meter.

SECTION 4. The consumers of the water supplied through any water meter shall make all necessary repairs for the proper operation of such water meter, and in case the City of Madison shall deem it necessary and expedient to repair a defective water meter, the expenses of such repair shall be chargeable to such consumers, and shall be paid at the time such repair was made, and in case of failure to pay for such repair, the Superintendent of the Water Works shall shut off the flow of water furnished through such meter.

SECTION 5. In case that any water meter should fail to register the quantity of water passing through the same, the consumers will be charged at the rate of the average daily consumption registered by such meter before the same became out of repair.

SECTION 6. In all cases where one service connection or yard hydrant does supply two or more separate consumers, premises, tenements, business houses or a block occupied by divers parties, one meter only will be placed at the service connection for either or all of said consumers, and the water rent as registered by said meter shall be chargeable to and payable by the owner of said premises or buildings.

SECTION 7. The rate of water rent to be charged where such meters are in use shall be according to the schedule rate established by ordinances, the minimum whereof being in all cases five dollars ($5) per annum.

SECTION 8. Water rents, where meters have been placed, shall be collected for first six months at the schedule rate. Thereafter as per record of meter the preceding six months in a manner as prescribed in section 13 of water works ordinance. No water meter rental will be charged by the city of Madison.

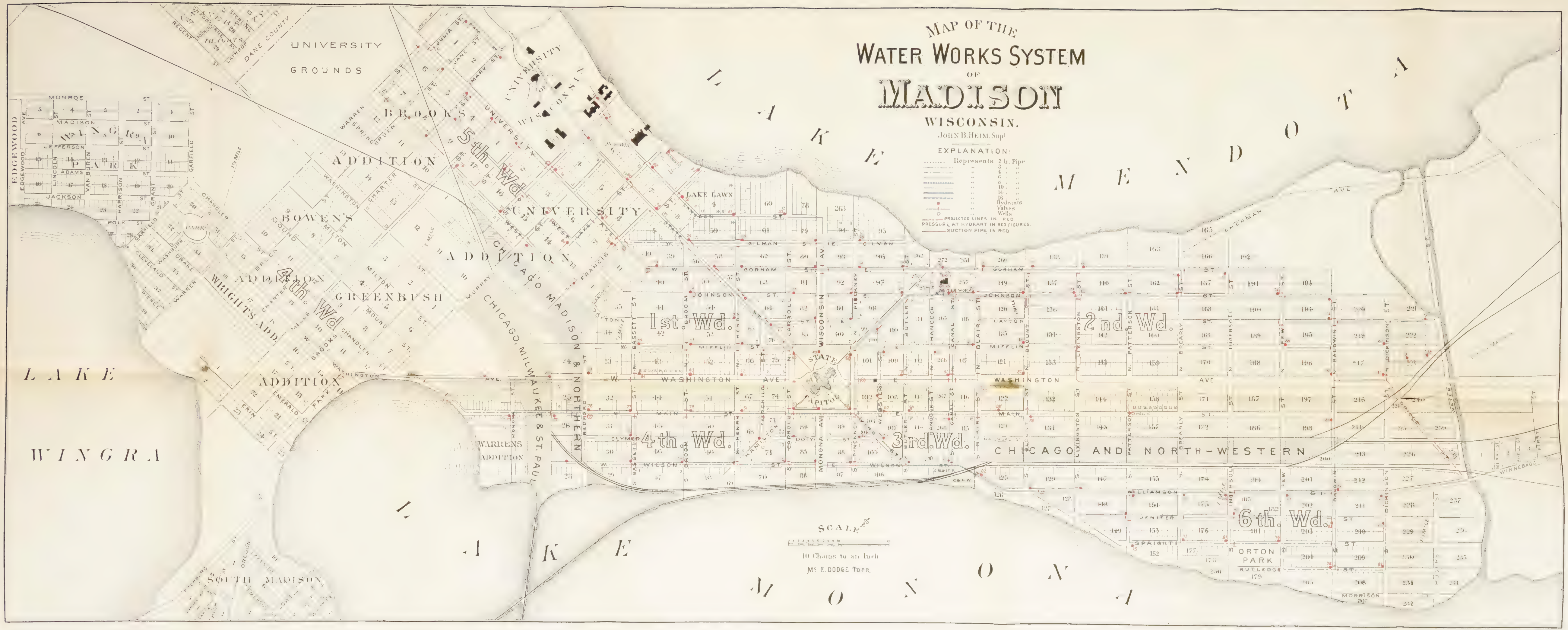
SECTION 9. The Superintendent of the Water Works system, or any person employed by the Board of Water Commissioners, shall be given free and ready access to the premises and buildings for the purpose of examining or repairing any meter or connection therewith. Any and all meters shall be left in the condition and manner as set by the city, and shall not be interfered with in any manner whatsoever.

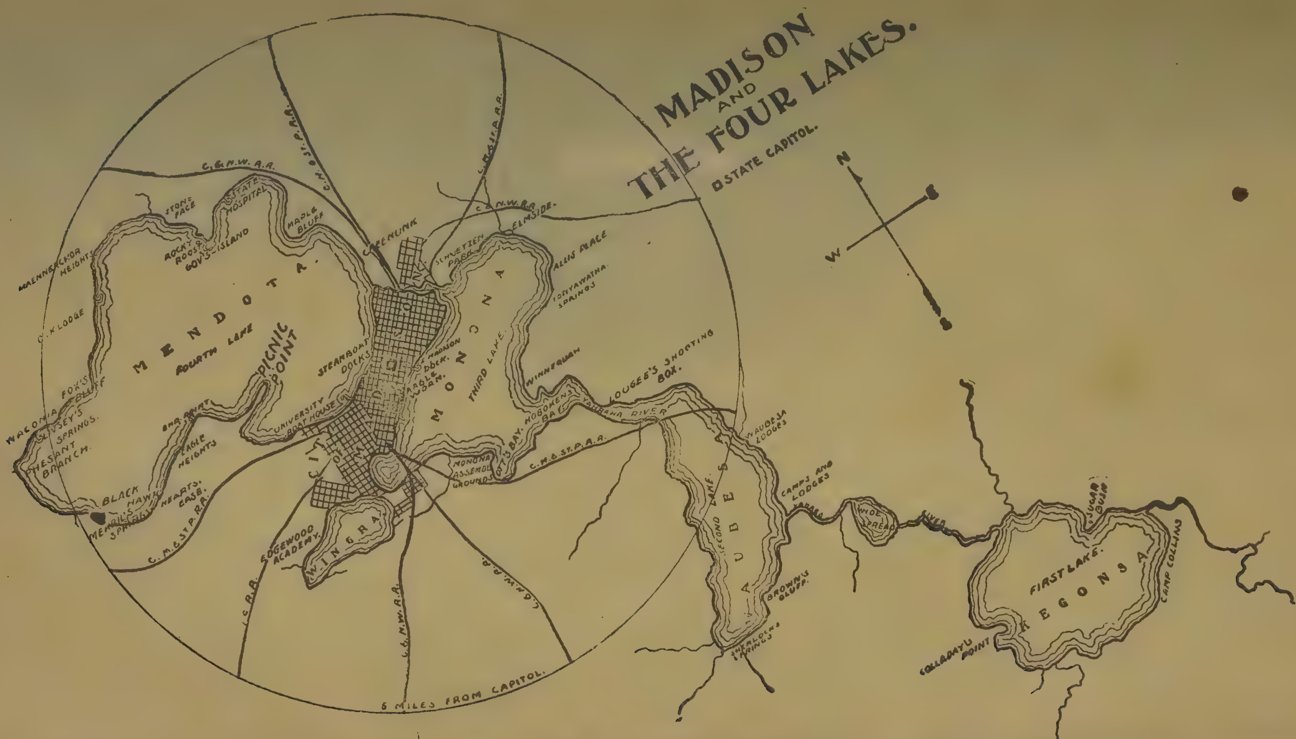
SECTION 10. In case of any violation of any of the foregoing rules and regulations, the water supply furnished to the consumer guilty of such violation shall immediately be shut off and shall not be resumed except upon a satisfactory adjustment of all the differences connected therewith, and upon the payment of the sum of one dollar for shutting off and turning on the water. Anybody violating any of these rules and regulations shall, upon conviction thereof, be subjected to a fine not to exceed twenty-five dollars ($25), and the cost of prosecution.

METER RATES.

6,000 cubic feet or less, per six months, per 100 cubic feet						20 cents
Over 6,000 cubic feet and less than 7,000, per six months, per 100 cubic feet						19 cents
Over 7,000	"	"	8,000,	"	"	18 cents
Over 8,000	"	"	9,000,	"	"	17 cents
Over 9,000	"	"	10,000,	"	"	16 cents
Over 10,000	"	"	16,000,	"	"	15 cents
Over 16,000	"	"	17,000,	"	"	14 cents
Over 17,000	"	"	18,000,	"	"	13 cents
Over 18,000	"	"	19,000,	"	"	12 cents
Over 19,000	"	"	20,000,	"	"	11 cents
Over 20,000	"	"	27,000,	"	"	10 cents
Over 27,000	"	"	28,000,	"	"	9 cents
Over 28,000	"	"	29,000,	"	"	8 cents
Over 29,000	"	"	30,000,	"	"	7 cents
Over 30,000	"	"	60,000,	"	"	6 cents
Over 60,000 cubic feet per six months, per 100 cubic feet						5 cents

Minimum, $5.00 per annum.


MAP OF THE
WATER WORKS SYSTEM
OF
MADISON
WISCONSIN.
JOHN B. HEIM, Supt
EXPLANATION
Represents 2 in. Pipe
Hydrants
Valves
Wells
PROJECTED LINES IN RED.
PRESSURE AT HYDRANT IN RED FIGURES.
SUCTION PIPE IN RED
LAKE MENDOTA
LAKE MONONA
LAKE WINGRA
UNIVERSITY GROUNDS
UNIVERSITY OF WISCONSIN
WINGRA PARK
BROOKS ADDITION
BOWEN'S ADDITION
UNIVERSITY ADDITION
GREENBUSH ADDITION
WRIGHTS ADD.
WARRENS ADDITION
SOUTH MADISON
LAKE LAWN
ORTON PARK
STATE CAPITOL
1st Wd.
2nd Wd.
3rd Wd.
4th Wd.
5th Wd.
6th Wd.
CHICAGO AND NORTH-WESTERN
CHICAGO, MILWAUKEE & ST. PAUL
CHICAGO MADISON & NORTHERN
WASHINGTON AVE
SCALE
10 Chains to an Inch
Mc C. DODGE TOPR


MADISON AND THE FOUR LAKES.
STATE CAPITOL.
N
W
MENDOTA.
FOURTH LAKE
PICNIC POINT
MONONA
THIRD LAKE
WAUBESA
SECOND LAKE
KEGONSA
FIRST LAKE
WINGRA
CITY OF MADISON
MAENNERCHOR HEIGHTS
STONE FACE
ROCKY ROOST
GOV'S ISLAND
STATE HOSPITAL
MAPLE BLUFF
FOX'S BLUFF
WACONIA
SPRINGS.
PHESANT BRANCH.
BLACK HAWK
MERRILL'S SPRINGS
HEARTS EASE.
EAGLE HEIGHTS
STEAMBOAT DOCKS
UNIVERSITY BOAT HOUSE
EDGEWOOD ACADEMY.
SCHUETZEN PARK
ELMSIDE.
ALLIS PLACE
TONYAWAWINA SPRINGS
WINNEQUAH
HOBOKEN'S BAY
LOUGEE'S SHOOTING BOX.
MONONA ASSEMBLY GROUNDS
WAUBESA LODGES
CAMPS AND LODGES
BROWN'S BLUFF.
SUGAR BUSH
CAMP COLLINS
POINT
C.&N.W.R.R.
C.M.&ST.P.R.R.
6 MILES FROM CAPITOL.

THIRTEENTH ANNUAL REPORT

...OF THE...

CITY WATER WORKS.

MADISON, WISCONSIN.

1895.

Compliments of

John B. Heim

Superintendent.

THIRTEENTH ANNUAL REPORT

OF THE

Board of Water Commissioners

OF THE

City of Madison.

FOR THE YEAR ENDING SEPTEMBER 30, 1895.

TOGETHER WITH

The Reports of Superintendent and Secretary.

MADISON, WISCONSIN,
DEMOCRAT PRINTING COMPANY, CITY PRINTER,
1896.

OFFICERS OF THE WATER WORKS.

JOHN R. MELVIN, President. . . .	Term expires October 1, 1898.
W. W. WARNER	Term expires October 1, 1896.
J. J. SILBERNAGEL	Term espires October 1, 1897.
JABE ALFORD	Mayor *ex officio.*
W. H. LANSING.	Alderman *ex offieio.*

O. S. NORSMAN, Secretary.

SUPERINTENDENT.

JOHN B. HEIM.

METER INSPECTOR.

NICKOLAS REIF.

ENGINEERS.

PETER GAUER, Chief,
A. LAWRENCE, 1st Asst.
DENNIS DACEY, 2d Asst.

FIREMEN.

PATRICK DORRIS.
CHAS. LINGARD.

WATER WORKS OFFICE.

City Hall, Second Floor.

REGULAR MEETINGS OF THE BOARD.

Tuesday previous to common council meeting of each month at 2:30 o'clock p. m.

All bills against the department must be rendered on or before the 28th of each month, or they will lay over until the following regular meeting.

WATER RENTS

Are due and payable, in advance, at the office of the city treasurer, on the first days of January and July of each year.

THIRTEENTH ANNUAL REPORT

OF THE

Department of Water Works.

REPORT OF THE COMMISSIONERS.

Office of the
Board of Water Commissioners,
City of Madison, Wis., February 11, 1896.

To the Honorable Mayor and Common Council of the City of Madison:

We have the honor to submit herewith our thirteenth annual report of the operations of the department of water works, for the year ending September 30, 1895. A full account is given by the superintendent of the operations of the department and of the improvements made during the year, together with a statement of the condition of the works at the present time. The suggestions and recommendations made by him have for their object, we fully believe, the increased efficiency and success of the city water works.

The secretary's statement gives an itemized account of the receipts and expenditures of the department during the

year, as well as the totals of all receipts and expenditures from its begining up to the present time.

We respectfully ask your careful perusal and consideration of the report as a whole, and particularly of the suggestions and recommendations made by the superintendent.

Respectfully submitted,

J. R. MELVIN,
W. W. WARNER,
J. J. SILBERNAGEL,
JABE ALFORD,
WM. H. LANSING,
Commissioners

SECRETARY'S REPORT.

STATEMENT

Of Receipts and Expenditures of the water works department of the City of Madison, Wisconsin, for the year ending September 30, 1895.

RECEIPTS.

From water rents	$20,556 19	
From water permits	348 00	
From plumbers' licenses	10 00	
From supplies sold, &c	100 53	
From tax, 1895	10,000 00	
Balance on hand Oct. 1, 1894	2,171 60	
EXPENDITURES.		
For construction and extension		$12,914 41
For operating expenses		13,468 87
For repairs		714 37
For water rent refunded		66 96
Transferred to Sinking Fund		5,000 00
Balance on hand October 1, 1895		1,021 71
	$33,186 32	$33,186 32

MISCELLANEOUS.

Total receipts of water rents from construction of the works to October 1, 1895	$167,844 40
Total receipts from water permits, same period	4,186 00
Total operating expenses to October 1, 1895	118,185 48
Total cost of extension and construction to October 1, 1895	297,278 06
Total cost of repairs to October 1, 1895	3,253 00
Amount of bonds issued for construction of works	76,000 00
Amount now outstanding of this issue	8,000 00
Water Works Extension Bonds issued in 1893	10,000 00
Total amount of bonds outstanding	18,000 00

Respectfully submitted,

O. S. NORSMAN, *Secretary.*

SUPERINTENDENT'S REPORT.

MADISON, WIS., February 1, 1896.

To the Honorable the Board of Water Commissioners.

GENTLEMEN:—I take pleasure in compliance with the water works ordinance, to submit to you the thirteenth annual report of this department, for the year ending Sept. 30, 1895, showing the conditions and improvements made during that period.

A SPLENDID SHOWING.

The past year has been the most prosperous since the construction, we having added 348 water takers to our list, 51 more than in 1883-84, which was the largest hitherto (namely 297) reaching the *2,000 mark.* We laid 1,296 feet of 16″ C. I. pipe for a new suction, 8,086 feet of C. I. water mains, and added 428 meters.

The pumping machinery is in first class condition, but becoming inadequate for present needs. The smaller pumps are now only used in case of repairs on the larger. The financial standing speaks well for the management, and the wise forethought of the Common Council of 1881–2, in placing the ownership in the hands of the city.

FINANCIAL.

From December 7th, 1882, when water was first furnished to patrons, until October 1st, 1895, we collected $172,030.40 from water rents and permits, and expended for operation from October 11th, 1882, until October1st, 1895, $118,185.48, leaving a net surplus of $53,844.92, which was placed in the construction fund. The original cost of construction was $95,027.54. The bonded indebtedness was $76,000.00, and $19,000 was borrowed from the sinking fund. Of this there remains to be paid but $8,000, and by the 1st of April,


FIRE & WATER.

1896, there will remain only $3,000. The indebtedness will be wiped out in fifteen instead of twenty years, as was contracted.

The cost of the plant October 1st, 1895, was $297,278.06; deducting the original cost of $95,027.54 leaves a balance of $202,250.52; deduct the net surplus of $53,844.92 brings the additional cost of construction to but $148,405.60, including $25,813.70 paid for meters, or a yearly average of $10,638.71, which sum was received from taxes, under the provision of the charter, with no additional levy for water works; no frontage tax; no receipts from hydrant rental; and water meters where furnished free to the consumers; with no monthly rental collected therefor; all water furnished free for city purposes, with a fire protection of 150 hydrants and over thirty miles of water mains.

Few people realize the benefits derived from the water works, through city ownership.

Had the city given franchise to a company, as proposed, the hydrant rental would have amounted to $17,600 the past year, and the company would have collected its own water rent, whereas through the city's ownership, the cost of construction and repairs, including the meters free to consumers, and services to curbstone, was only $13,628.78, deducting the net receipts from water rents of $7,435.32 leaves an outlay of but $6,193.46, and we are owners of a plant that is worth three times its cost to the present date.

The following table shows the receipts and expenses since construction:

TABLE.

Year.	No. of tak- ers.	Water rents.	2 engineers and 2 firemen.	Salar- ies.	Cost of coal per ton.	Opera- ting ex- penses.	Av. per taker collec- ted.
Dec. 7, '82 to Oct. 1, '83.	256	$2,600 30	.... do	$3,680	$6 17	$3,765 05	$15 00
Oct. 1, '83 to Oct. 1, '84.	553	7,170 39	.... do	3,880	5 00	7,033 13	12 96
Oct. 1, '84 to Oct. 1, '85.	699	9,070 06	.... do	3,880	4 10	8,788 25	12 50
Oct. 1, '85 to Oct. 1, '86.	876	11,023 36	.... do	3,880	4 10	8,135 29	11 78
Oct. 1, '86 to Oct. 1, '87.	980	13,479 69	.... do	3,880	7 24	8,739 73	13 48
Oct. 1, '87 to Oct. 1, '88.	1,099	14,017 40	Meter inspector added...	4,480	8 33	9,503 75	12 76
Oct. 1, '88 to Oct. 1, '89.	1,229	13,670 37	... do	4,480	5 75	11,735 94	10 91
Oct. 1, '89 to Oct. 1, '90.	1,355	13,388 43	3 engineers, no fireman	4,600	4 82	7,564 25	9 69
Oct. 1, '90 to Oct. 1, '91.	1,405	15,372 26	.... do	4,600	4 10	8.052 24	10 77
Oct. 1, '91 to Oct. 1, '92.	1,554	15,330 83	3 engineers, 1 fireman......	5,340	5 95	8,827 90	9 86
Oct. 1, '92 to Oct. 1, '93.	1,701	16,499 70	.... do	5,340	5 95	10,458 79	9 53
Oct. 1, '93 to Oct. 1, '94.	1,820	18,798 44	3 engineers, 2 firemen.	6,000	5 27	11,626 01	10 20
Oct. 1, '94 to Oct. 1, '95.	1,994	20,904 19	.... do	6,000	4 12	*13,468 87	10 48

*Included outlay for coal of $2,506.19 paid for the year 1895-6, instead of monthly payments as heretofore.

ADDITIONAL WATER SUPPLY.

As recommended in the reports of 1893-4, of lowering and enlarging the suction pipe, between the pumping station and Blount St., to increase our water supply, you took the matter under advisement, with the greatest care, calling also on Edwin Reynolds, C. E., of Milwaukee, Wis., for his opinion, who gave recommendations as follows:

MARCH 25th, 1895.

Board of Water Commissioners, Madison, Wis.:

GENTLEMEN—In compliance with your request I visited the works at Madison, on the 19th inst., for the purpose of ascertaining what could be done to increase the quantity of water at the station. From such observations as I was able to make in person, taken into connection with the data furnished by the superintendent and the engineer at the station, I reached the following conclusion:

First. The suction pipes leading down into the wells should be lengthened, carrying them down about fifty feet below center of pumps so as to prevent the possibility of air being taken in at any well under present or future conditions that may be established.

Second. I would advise the laying of a sixteen inch suction main to replace all of the 12 in., 10 in. and 8 in. pipe in the main suction line, between the 16 in. at the engine house and the 12 in. at the opposite end of the line, making about 1,296 feet of new 16 in. pipe. This pipe should be started at the level of the 3,400 feet of 12 in. pipe, and be laid with, say,

one foot total rise from there to its junction with the 16 in. main. This is advised with a view at some later day of continuing this 16 in. pipe through to a new pump which would be placed 10 ft. below the level of those at present in use.

The change in suction pipe as suggested, I estimate will enable you to increase the speed of your pumps, as they now stand, about eight revolutions per minute, or an increase in your present capacity of about 25 per cent. I would advise making the connection between the 16-inch suction on the old and new levels with 45° bends for the purpose of reducing the friction to the lowest possible point.

After the change in suction pipe is made, it will then be possible to lower your present pumps five feet, carrying them down to the level of the present suction pipe in the engine house. This change made, would still further increase your supply to about 60 per cent. above what you are now getting.

You will doubtless find it necessary, in the not distant future, to increase your pumping machinery and I would then advise placing the new pumps 10 feet below those now in use, or five feet below the present suction pipe, which would bring the new pumps down to the new level established for the new 16-inch main, which could be carried through from its junction with the old 16-inch on a level, to the new pump well. This change, properly carried out, would increase your present supply about 90 per cent. from the existing wells.

I am also of the opinion that it would be a wise precaution for your city to construct additional storage capacity for use in case of any serious conflagration. This new storage basin should, in my judgment, be of at least double the capacity of the present one and could be used in connection therewith.

Should you decide on lowering the present pumps I would be pleased to submit a plan for doing this, leaving the engine stand where it now does.

In laying the new suction pipe it is very important that it be laid accurately to the established grade so as to prevent the accumulation of air at any point, and it must also be absolutely tight. It should be carefully tested under pressure before being covered.

Trusting that I have made my recommendations clear to you, I am,

Yours truly,
(Signed) Edwin Reynolds.

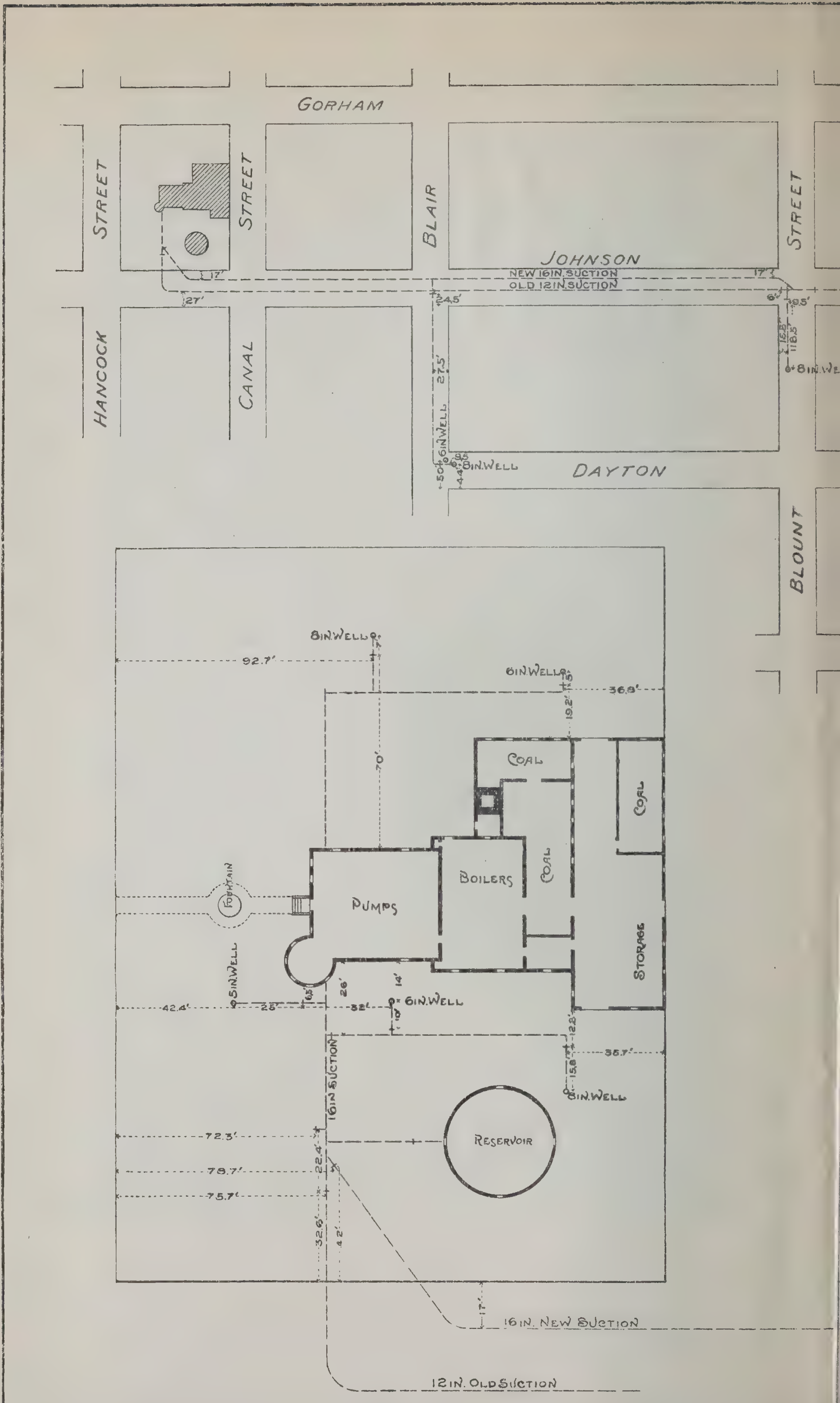
Upon your order we proceeded to lay 1,296 feet of 16 in. c. i. pipe, to connect at the intersection of Blount street with the 12 in. c. i. pipe, at an average depth of 10 feet, under the greatest difficulties, being compelled to fight water and quicksand, which necessitated an expenditure of $4,789.09, or $3.62 per foot. After this pipe was laid it

was carefully tested and only five leaks found, a very satisfactory result.

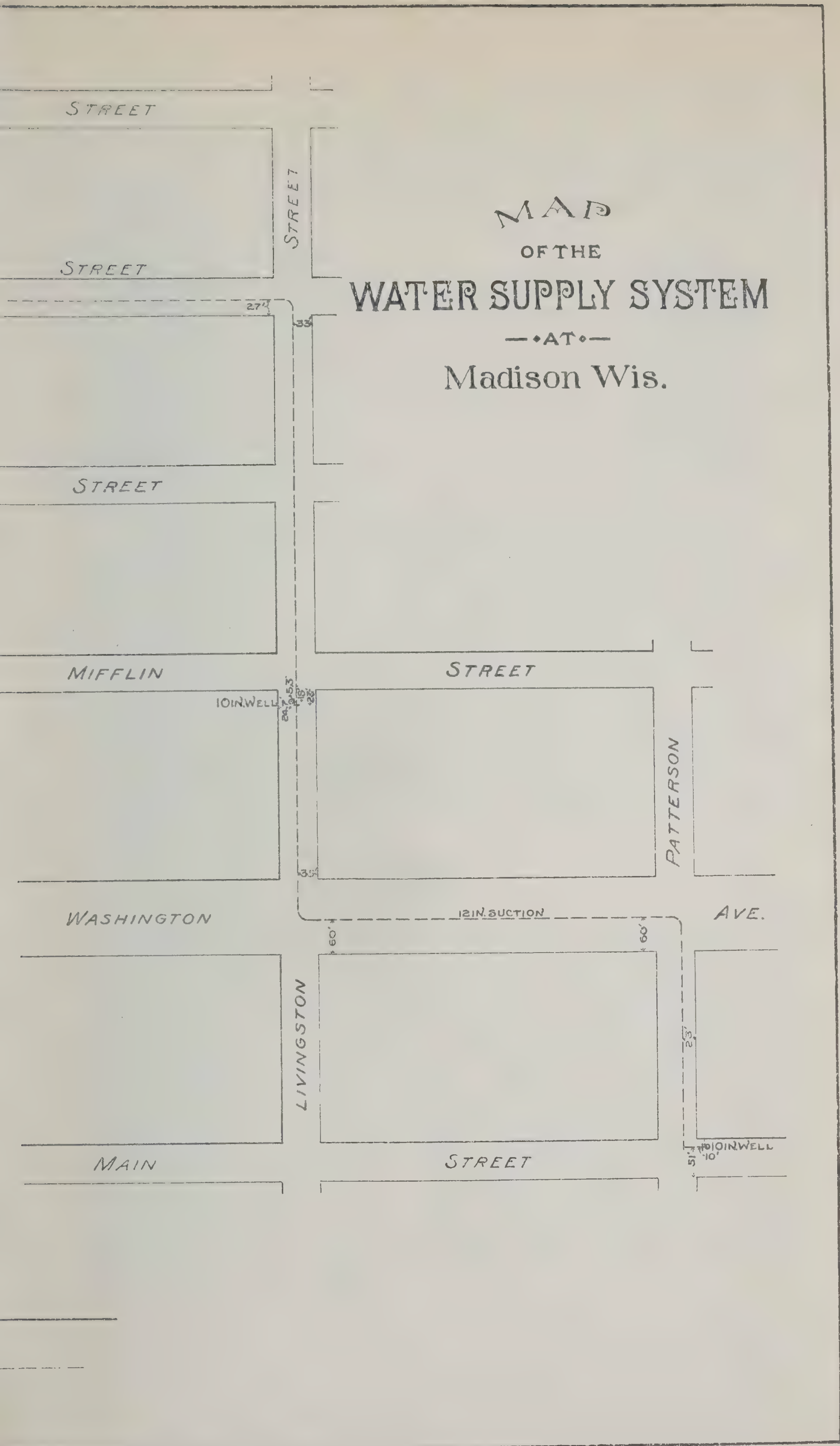
After this work was accomplished we increased the length of the tubing in the wells from 25 to 50 feet. In the examination of the wells we found that the tubing of the first well was 9 ft. 2 in. shorter than it ought to be, which meant that when we drew water below that we lost suction. The suction pipe from the main section of the two first wells, was ordinary well tubing without tar coating and had reached the limit of its life, and rusted through in spots, as also of the third well which was c. i. pipe but not coated. These three wells were built and connected under the supervision of the engineer of construction.

After all leaks were stopped, we made a test of the increased results, which are most gratifying, being even beyond anticipation and calculation. The test was made during the first week in January, with emptying the water from the hydrants into the lake, drawing on our full source of supply, as during the drought last summer to our limit, finally, after having drawn to that seemable exhaustion, we continued for another 18 consecutive hours with the results given below. (We are still hampered by the old suction connected with the new between Blount street and Station, which causes us to draw air, which should be disconnected as soon as the frost is out of the ground.)

The total water pumped during these 18 hours was 1,320,000 gallons, which would be in 24 hours 1,760,000 gallons (we actually pumped that day during 24 hours 1,683,000 gallons). This was done at a vacuum of 19 inches; at a vacuum of 24 inches it will give us an increase of 20 per cent. more. The pumpage per hour was 1,060 gallons per minute at 19 inches, at a speed of the engine of 48 revolutions per minute. Last August, during the dry spell, we could not pump more that 726 gallons per minute at a vacuum of 22 inches, and at a speed of the engine of 33 revolutions per minute, this means an increase of 334 gallons per minute, showing 45 per cent. and 7 revolutions more than calculated.



GORHAM
STREET
STREET
BLAIR
STREET
JOHNSON
NEW 16 IN. SUCTION
OLD 12 IN. SUCTION
HANCOCK
CANAL
6 IN. WELL
8 IN. WELL
8 IN. WELL
DAYTON
BLOUNT
8 IN. WELL
6 IN. WELL
COAL
COAL
COAL
BOILERS
PUMPS
FOUNTAIN
STORAGE
5 IN. WELL
6 IN. WELL
8 IN. WELL
16 IN. SUCTION
RESERVOIR
16 IN. NEW SUCTION
12 IN. OLD SUCTION


MAP
OF THE
WATER SUPPLY SYSTEM
—•AT•—
Madison Wis.
STREET
STREET
STREET
STREET
MIFFLIN
STREET
10 IN. WELL
PATTERSON
WASHINGTON
12 IN. SUCTION
AVE.
LIVINGSTON
MAIN
STREET
10 IN. WELL
27'
33'
35'
60'
60'
23'
51'
10'

To substantiate our figures we will give the highest pumpage of last summer, being from the 15th to the 23d of August, when we were compelled to cut off the street sprinklers, and placing them on half time, drawing water from reserve basin at same time.

August 15th we pumped	1,100,000 gallons.
August 16th we pumped	1,188,000 gallons.
August 17th we pumped	1,210,000 gallons.
August 18th we pumped	1,012,000 gallons.
August 19th we pumped	1,100,000 gallons.
August 20th we pumped	1,144,000 gallons.
August 21st we pumped	1,100,000 gallons.
August 22d we pumped	1,132,000 gallons.
August 23d we pumped	1,232,000 gallons.

With this increase in our water supply, should we suffer from a drought as last year, we can pump 1,760,000 gallons, before calling on the reserve basin for aid. With the lowering of the large pump, and an additional pump of three million gallons capacity, placed ten feet lower than the present pumps, to connect with this new 16 inch suction, and a general meter system, we will be able to meet all demands for years to come. Annexed is a map showing the suction and location of wells for future reference, including a 16 inch valve to connect with suction for new pumps:

METERS.

During the year we added 428 meters, which makes to date 1,223, and by January 12, 1896, two-thirds of the water takers will be under the meter system. Your endeavor has been to place the water takers as fast as possible under the meter system, but under the conditions of so many other improvements, and the rapid growth of new takers, we were only able to place 80 meters on old services. Indications point to a large increase of patrons the coming season, and as a new meter is placed on every new service, preparations ought to be made for the purchase of 600 meters, giving us about 300 meters for old services, still leaving 471 to be added.

The meter system is the only true method of selling water, checking the waste, solving the problem of our success. How would it be possible for us to supply 1,994 water takers under the schedule system from our artesian wells?

I have prepared a table showing the number of takers and meters in use since October 1st, 1884, which is a fair criterion, the preceding two years not being on a well established basis, the amount of water pumped, coal consumed, and the per capita:

Year.	No. of takers.	No. of meters.	Gallons water per year.	Gallons water per day.	Pounds coal per year.	Pounds coal per day.	Galls. per capita.
1884-85	699	3	199,333,840	546,120	1,210,150	3,315	48
1885-86	876	5	236,649,850	648,355	1,339,900	3,671	53
1886-87	980	5	261,308,160	715,885	1,124,200	3,123	59
1887-88	1,099	210	257,682,300	704,050	1,047,200	2,861	58
1888-89	1,229	385	195,450,770	535,480	914,500	2,540	44
1889-90	1,355	441	190,810,910	520,030	1,331,500	3,648	43
1890-91	1,405	498	197,889,450	542,162	1,044,000	2,860	38
1891-92	1,554	547	236,035,800	646,753	1,173,100	3,214	47
1892-93	1,701	673	268,246,300	734,921	1,302,200	3,567	50
1893-94	1,820	795	272,006,950	745,224	1,393,800	3,819	48
1894-95	1,994	1,223	313,705,500	859,467	1,514,400	4,152	53

Thus it will be seen that our per capita increased until we adopted the meter system, when it diminished until in 1891, when we were obliged to use two boilers, to secure better fire protection, compelling us to do work of a 60 H. P. boiler with a 150 H. P. boiler. Macadamizing of streets brought on an increase of street sprinkling, which means, on an average of 144,000 gallons per day of four sprinkling carts. A water motor in the 6th ward school was also connected, which consumes 75,000 gallons of water in 10 hours. Still with all that our per capita was not any more in 1895 than in 1885. Deducting from the above the 21,600,000 gallons of water used by street sprinklers, 11,250,000 gallons used through motor in 6th ward school, 6,000,000 gallons for schools and public buildings, 6,000,000 gallons for public fountains and flushing, will average a per capita of 8 gallons, bringing our per capita to 45 gallons. The cost of coal for each taker in 1884 and 1885 per annum was $2.36, based on the price of $4.12 per ton, whereas, under the meter system during the past year it cost only $1.64.

The amount of water pumped for each taker, including all water pumped, was 839 gallons in 1884-5, and only 431 gallons in 1894-5, with 771 water takers receiving water without meters. The saving of water through the meter system in 1894-95, comparing with 1884-85, was 813,552 gallons per day. The amount of water that passed through the meters the past year was 86,323,803 gallons, for which the city received $13,373.70. The amount received for unmetered water during same period, deducting the metered water, the estimated water for street sprinkling, motor purposes, schools, public buildings, fires and flushing, was $7,182.49 for 182,003,497 gallons. The above results prove that, when our general meter system is complete, that you will be able to reduce the rates and the minimum, and have money for needed improvements which cannot be gained any other way. Our present meter rates do not quite overcome criticism, and appear to encourage waste, and in some instances is taken advantage of; a revision of the same ought to be made before the next rent day.

FIRE PROTECTION.

A great deal of alarm has been felt, of the shortage of water, in case of a large conflagration, and justly so, but with our efficient fire department, and the water pressure *ever ready*, no fire has got beyond control, when alarm was given in due time, but if the fire should have a head start, as in Chicago, Milwaukee, Oshkosh, etc., that draw their water from the lake, we would be no more able to control the fire than they were, if we pumped the water from Mendota. The amount of water pumped for fires the past year was 528,200 gallons, at a cost of $12.31. Complaints have been made of insufficient pressure at several fires, little thinking that the cause was not at the pumping station, but the indiscretion of connecting too many fire streams. For instance, the 30th of last March at the fire of the Fuller and Johnson M'f'g Co., which is supplied through a six inch main of 6,930 feet at hydrant, cor. Dickinson St. and Washington Av., circulating through a six inch on the

avenue, indicating 86 pds. at that point. We carried during the fire 120 lbs. pressure. Had two streams been used, it would have meant 90 lbs. pressure, and sufficient to extinguish the fire. With four streams it would mean a reduction of pressure to 75 lbs.; with six streams a reduction to 50 lbs; and with eight streams a reduction to 25 lbs. Eight streams were used at this fire. The greater the distance from the pumps, the greater the loss in friction, and the more openings, the less pressure. It is not necessary, to connect with hydrants in the vicinity, because you have the hose at command, and anxious to play on the fire. *Another precaution necessary, is, to prevent loss of pressure; to see, that all hose couplings during the fire are water tight.*

STREET SPRINKLING.

Through the improvement of our streets street sprinkling will increase, and a continuous draught on our water supply. We supplied the past year four sprinkling wagons, each tank having a capacity of 600 gallons, and they were filled at times every five minutes, which means 2,400 gallons at a time, but will make the average only every ten minutes, which would mean 14,400 gallons per hour, and at an average of 10 hours per day, 144,000 gallons. Calculating at 150 days, 21,600,000 gallons. At our lowest meter rate the city would have received for this amount of water $1,375.15, but actually received only $500.

Setting the financial part aside, it is a continuous drawback on the water works system, and at all times endangers the water supply.

DOUBLE SYSTEM.

A double system of pipes has been suggested to answer this purpose. This certainly is out of the question. The first cost would be carrying a 16″ main 1,000 feet out into the lake which is requisite on account of the shallowness at that point from the station, carried up to and on Hamilton street to Webster, on Webster, Doty, Fairchild and Dayton streets to Hamilton street including additional building,

engines and pumps, of $28,000. Soon the call would come on additional streets, finally ending with a duplicate water main system, of from $75,000 to $100,000 invested with increased interest, operating expenses, and a nominal revenue derived.

WATER MOTORS.

Another evil we have to contend against, is furnishing water for motors. This should be prohibited entirely. The amount of water consumed by the motor in the sixth ward school, upon examination was found to be at least 125 gallons per minute, which means 7,500 gallons per hour, and per day of 10 hours, 75,000 gallons; 200 days 15,000,000 gallons.

The record of pumpage during the week of vacation and the second week of school after vacation (during the first week we made our test) is herewith given, and is more than 75,000 gallons per day.

Days.	Vacation	Days.	School.	Difference.
	Gallons.		Gallons.	Gallons.
Monday, Dec. 30, 1895........	781,000	Monday, Jan. 13, 1896	1,012,000	231,000
Teesday, Dec. 31, 1895........	775,000	Tuesday, Jan. 14, 1896......	1,001,000	226,000
Wednesday, Jan. 1, 1896	826,750	Wednesday, Jan. 15, 1886 ...	1,067,000	240,250
Thursday, Jan. 2, 1896.......	711,500	Thursday, Jan. 16, 1896	1,057,000	345,500
Friday, Jan. 3, 1896	742,250	Friday, Jan. 17, 1896	1,034,000	291,750

This of course includes all schools, but proves conclusively, that both jets must have been used on the motor, and run longer than ten hours.

There certainly would be no objection to this motor, if we had an abundance of water, but with this continuous drain on our limited supply, endangering our fire protection for want of pressure, it would be a benefit to all concerned, to have this motor placed under some other motor power.

LOWERING OF WATER MAINS.

An established grade ought to be adopted all over the city, so that we could place our water mains at such depth below frost that when grading for macadamizing of streets

is done no extra expense would be incurred to lower the main and services. This expense amounted to $609.78 the past year.

PERMITS.

During the past year we issued 348 original water permits, making total takers Sept. 30, 1895, 1,994.

WATER RENTS.

The annual revenue from the 1,994 takers was $20,556.19, water permits $348, a total of $20,904.19, which is an increase over last year of $2,105.75. The average for each taker was $10.48.

OPERATING EXPENSES.

The operating expenses for the year ending September 30th, 1895, was $13,458.87. We used the anthracite pea coal, contracted for with Conklin & Son, they being the lowest bidder, at $4.12 per ton. The receipts from water rents and permits being $20,904.19, leaving a balance of $7,435.32 (an increase over last year of $500.89), which was placed in the construction fund.

CONSTRUCTION EXPENSES.

The construction, repairs, meters, extensions and improvements for the year ending Sept. 30, 1895, was $13,628.78.

SERVICE CONNECTIONS.

During the year we laid 4,823 feet of services, which brings the number of feet of services laid to curbstone, to 55,016 feet, or $10\frac{2216}{5280}$ miles of lead pipe. We also laid 3,283 feet of services to curbstone, before the new streets were macadamized, to prevent tearing up streets when called for. These are not included in the above summing up. The following tables show on what streets services were laid of new takers, and those ready for connection, the past year, size and number of feet on each street and the total:

Table showing service pipe laid for new takers.

Streets and Avenues.	⅝ In.	¾ In.	2 In.	Total.
Baldwin	67	19	....	86
Bassett	86	....	....	86
Blair	48	....	....	48
Blount	29	....	....	29
Broom	29	....	....	29
Bruen	48	....	....	48
Butler	106	....	....	106
Canal	77	....	....	77
Charter	19	....	....	19
Clymer	192	....	....	192
Dayton	335	....	....	335
Dickinson	....	19	29	48
Few	29	....	....	29
Francis	65	....	150	215
Gilman	87	....	....	87
Gorham	365	58	....	423
Hamilton	66	....	....	66
Hancock	66	....	....	66
Henry	125	....	....	125
Jane	38	....	....	38
Jenifer	335	....	....	335
Johnson	385	....	....	385
Julia	29	....	....	29
Lake	135	....	....	135
Langdon	156	....	....	156
Livingston	42	....	....	42
Main	48	....	....	48
Mary	37	....	....	37
Mifflin	193	....	....	193
Mills	116	....	....	116
Monona	12	....	....	12
Murray	48	....	....	48
Park	....	19	....	19
Pinckney	13	19	....	32
Spaight	143	....	....	143
State	61	....	....	61
University Ave	260	....	....	260
E. Washington Ave	62	....	....	62
W. Washington Ave	137	....	....	137
Webster	29	....	....	29
Williamson	239	....	....	239
Wilson	153	....	....	153
Totals	4,510	134	179	4,823

Table showing services laid to curbstone before macadmizing of streets to prevent tearing up for connection hereafter.

Street.	Size.	Number of taps.	Number of feet.
Broom	⅝	9	191
Dayton	⅝	5	135
Hancock	⅝	14	306
Jenifer	⅝	43	1,047
Patterson	⅝	1	29
Rutledge	⅝	24	626
Spaight	⅝	42	949
Total	⅝	138	3,283

NEW MAINS.

During the past year we laid 8,086 feet of four inch cast iron pipe, located four hydrants, and fourteen four inch valves. Laid 1,296 feet of 16 inch C. I. pipe for suction from the wells, two 16 inch valves, one 12 inch and one 8 inch valves, lowered 700 feet of 12 inch suction pipe on Johnson and Livingston streets, at an average depth of five 123 feet of 8 in. on Blount street, and 247 feet of 8 in. feet. on Blair street, to conform to the new 16 in. suction, and connected with it. We also lowered 160 feet of 6 in. water main on Williamson street, 300 feet of 4 in. water main on North Broom street to conform with grade given for macadamizing, and 660 feet of 4 in. main on West Dayton street to conform with grade.

The following table shows the extension made during the year, giving size, where laid and the number of feet, also where hydrants and valves were placed:

Street.	16 inch suction.	4 inch.	No. of pieces.	Hy- drants.	Valves.
North Bassett street..........	....	1,630	136	1	3
Bruen street..................	....	995	83	....	1
East Dayton street...........	....	990	83	....	2
North Ingersoll street........	....	330	28	....	1
South Ingersoll street........	....	330	27	1	1
Jane street...................	....	620	52	....	1
West Johnson street..........	....	1,925	160	1	3
Murray street................	....	580	49	....	1
Rutledge street...............	....	686	57	1	1
East Johnson street between station and Blount street....	1,296	....	108	....	4
Total	1,296	8,086	....	4	18

The total mileage of water main Sept. 30, 1895 is 30 $\frac{1387}{5280}$ miles, 150 hydrants, 189 valves, 5,753 feet of suction pipe, with 17 valves.

MANAGEMENT.

The thirteenth year of the existence of our water works is now completed, its efficiency and management has been commended, not only by our own citizens, but also by the outside world. They are a monument to your care, zeal, and watchfulness.

My endeavor has been to carry out your intentions and instructions. The civil service gives the best and most satisfactory results in handling the employes of the department, the city reaps the benefit in good work, through better care and skill in their several branches. I wish to express my grateful appreciation to each member of the board, for the kind forbearance, assistance, and valuable counsel rendered, in the discharge of my duties. With your kind aid, as in the past, it shall be my endeavor to labor for the continuous success, and increased results of the *Madison City Water Works.* I also desire to express to all employes connected with the Department, and those who have assisted me in the performance of my duties, my satisfaction and appreciation, for the prompt, ever willing, and faithful discharge of their respective duties.

Respectfully submitted,

JOHN B. HEIM,

Superintendent.

Record of fires during the year.

Date.	Time.	Duration.	Gals. of water pumped for fire.	Pressure at station in lbs.	False alarm.	No. of box.
Oct. 7, 1894..	11:30 p. m.	30 m.	12,000	90-95	....	41
Oct. 10, 1894..	11:15 a. m.	20 m.	8,000	75-80	....	26
Oct. 10, 1894..	11:45 a. m.	....	....	....	no wat'r	46
Oct. 12, 1894..	11:05 p. m.	10 m.	4,000	90-95	....	45
Oct. 17, 1894..	1:25 a. m.	15 m.	6,000	90-95	....	21
Oct. 18, 1894..	10:35 a. m.	....	....	....	no wat'r	26
Oct. 22, 1894..	3:15 a. m.	....	....	....	no wat'r	28
Oct. 25, 1894..	1:50 a. m.	30 m.	12,000	90-100	....	45
Nov. 3, 1894..	3:30 p. m.	....	....	....	no wat'r	26
Nov. 9, 1894..	2:30 p. m.	....	....	....	no wat'r	21
Nov. 11, 1894..	1:00 a. m.	....	....	....	no wat'r	18
Nov. 17, 1894..	6:00 p. m.	12 m.	7,200	80-90	....	45
Nov. 21, 1894..	2:45 a. m.	40 m.	22,000	80-95	....	14
Nov. 28, 1894..	4:15 a. m.	15 m.	6,000	80-95	....	61
Nov. 30, 1894..	3:00 a. m.	1:45 m.	57,000	85-100	....	34
Dec. 17, 1894..	5:00 a. m.	20 m.	8,000	80-90	....	28
Dec. 27, 1894..	5:30 a. m.	....	....	....	no wat'r	28
Dec. 27, 1894..	8:40 p. m.	....	....	....	no wat'r	14
Dec. 28, 1894..	3:55 p. m.	30 m.	9,000	80-90	....	26
Jan. 3, 1895..	2:50 a. m.	2:10 m.	84,500	80-100	....	53
Jan. 8, 1895..	8:00 a. m.	05 m.	1,000	75-80	....	18
Jan. 25, 1895..	8:00 p. m.	....	....	....	no wat'r	21
Jan. 29, 1895..	12:10 p. m.	15 m.	6,000	75-80	....	61
Feb. 6, 1895..	7:00 p. m.	....	....	....	no wat'r	34
Feb. 27, 1895..	6:05 a. m.	10 m.	2,000	85-90	....	....
March 4, 1895..	12:25 a. m.	55 m.	22,000	90-100	....	22
March 11, 1895..	5:55 p. m.	2:30 m.	72,000	78-100	....	43
March 17, 1895..	5:00 a. m.	....	....	....	no wat'r	51
March 18, '95..	12:20 p. m.	2:15 m.	30,000	80-90	....	46
March 19, '95..	2:00 a. m.	....	....	....	no wat'r	23
March 30, '95..	2:10 p. m.	40 m.	44,000	80-120	....	3 and 24
April 12, '95..	4:50 p. m.	05 m.	2,000	80-100	....	28
April 12, '95..	6:05 p. m.	35 m.	14,000	80-100	....	45
April 15, '95..	5:20 a. m.	....	....	....	no wat'r	64
April 15, '95..	10:25 a. m.	....	....	....	no wat'r	21
April 26, '95..	12:30 a. m.	....	....	....	no wat'r	51
May 5, '95..	1:40 a. m.	05 m.	2,000	90-100	....	18
May 8, '95..	10:00 a. m.	....	....	....	no wat'r	16
May 12, '95..	2:30 a. m.	....	....	....	no wat'r	31
May 15, '95..	8:15 p. m.	....	....	....	no wat'r	53
May 31, '95..	3:15 p. m.	....	....	....	no wat'r	16
June 25, '95..	10:30 p. m.	20 m.	10,000	80-85	....	14
July 4, '95..	3:00 p. m.	30 m.	16,000	110-120	....	45
July 11, '95..	10:55 p. m.	35 m.	18,000	110-120	....	14
July 12, '95..	11:30 a. m.	45 m.	18,000	80-90	....	61
July 24, '95..	8:25 p. m.	....	....	....	no wat'r	46
Aug. 12, '95..	5:25 p. m.	....	....	....	no wat'r	43
Aug. 13, '95..	4:10 a. m.	45 m.	13,500	70-80	....	43
Aug. 19, '95..	12:50 a. m.	....	....	....	no wat'r	65
Aug. 31, '95..	1:45 a. m.	15 m.	6,000	80-105	....	45
Sept. 10, '95..	1:40 a. m.	....	....	....	no wat'r	31
Sept. 20, '95..	9:00 p. m.	40 m.	16,000	90-100	....	24
Sept. 29, '95..	12:45 p. m.	....	....	....	no wat'r	51

SUMMARY OF STATISTICS.

REPORT OF 1894 AND 1895.

City Water Works, Madison, Dane County, Wisconsin.

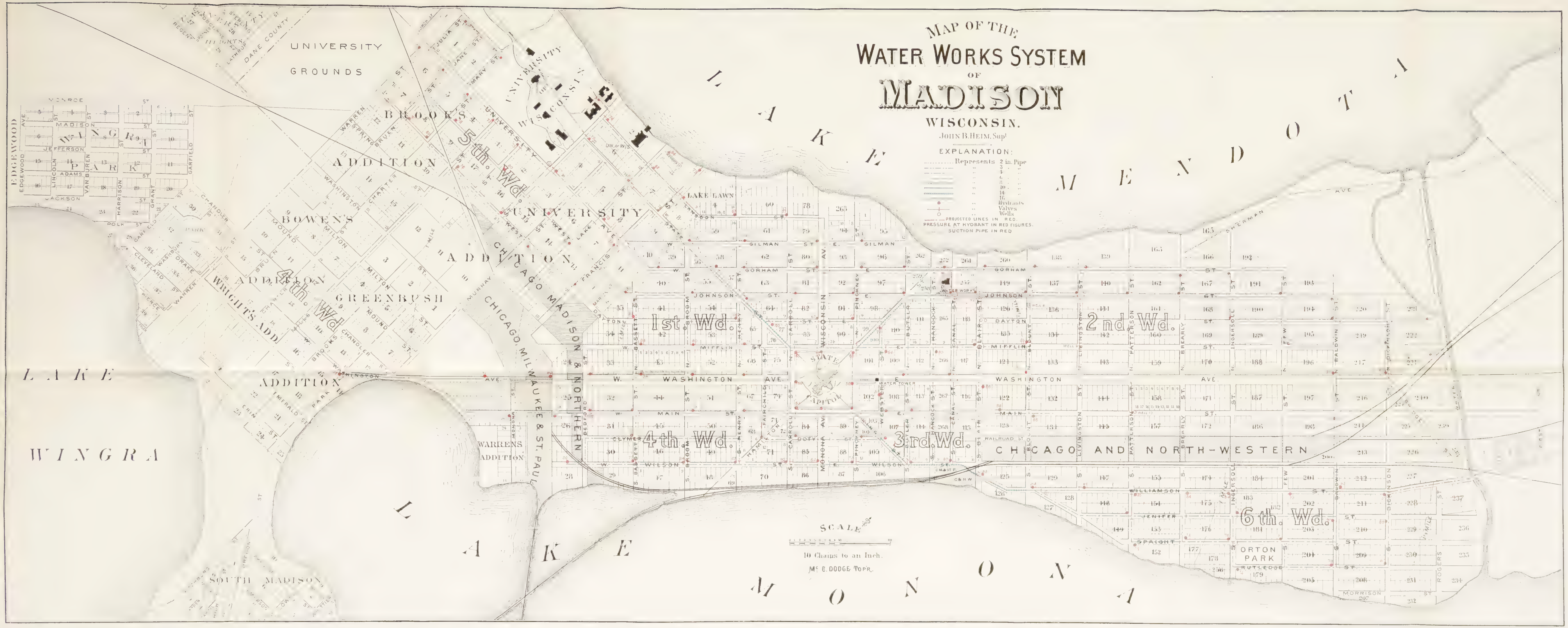
Population by census of 1895	15,950
Date of construction	1881–82
By whom owned	City of Madison.
Source of supply	10 artesian wells.
Mode of supply	Direct pressure.
Pumping machinery	Reynolds-Corliss.
Engines	With Knowles pumps combined.
Description of coal	Anthracite pea.
Coal consumed for the year in pounds	1,514,200
Coal consumed for the year in pound net combustible	1,287,070
Average static head against which pumps work	197 ft.
Average dynamic head against which pumps work	218 ft.
Number of gallons pumped per pound of coal	$207\frac{17}{100}$
Number of gallons raised 100 feet per pound of coal	$451\frac{63}{100}$
Duty in foot pounds per 100 pounds of coal, making no deductions for starting, banking fires, heating building, etc	37,621,828
Cost of pumping, figured on total maintenance per million gallons raised against average	$\$42\frac{935}{1000}$
Per million gallons raised one foot high	$19\frac{71}{100}$
Total number of gallons pumped for the year	313,705,750
Average daily consumption	859,467
Number of takers	1,994
Number of meters	1,223
Average gallons pumped per day each taker	431
Average gallons pumped per day, each inhabitant	53

DISTRIBUTION.

Kind of pipe	cast iron, from 3 to 16 in.
Total miles of mains	$30\frac{1387}{5280}$
Total hydrants	150
Total valves	189
Total miles of services (lead)	$10\frac{2216}{5280}$
Total feet of cast iron suction pipe	6,279

ANALYSIS OF WATER.

Potassium sulphate	0237
Sodium sulphate	0.286
Sodium phosphate	trace
Bi-carbonate of soda	1.094
Bi-carbonate of lime	15.234
Bi-carbonate of magnesia	12.984
Bi-carbonate of iron	0.214
Sexqui-oxide of aluminum	trace
Silica	0.414
Sodium chloride	0.292
Organic matter	none
Total solid contents per gallon	30.755



THE MILWAUKEE LITHO & ENGR

FIRE ALARM.

Signals of the fire alarm from bells and whistle are as follows, and is same number of blows as number of box:

SIGNAL BOXES.

Box. *Location.*

3—Fuller & Johnson W'ks, 3 blows.

FIRST WARD.

12—Wisconsin Av. and Gorham st.
14—State, Gilman and Broom.
16—Mifflin and Broom.
18—State and Fairchild.

SECOND WARD.

21—Washington Av. and Canal st.
23—Dickinson and Dayton.
24—Johnson and Few.
26—Johnson and Patterson.
28—Pinckney, Mifflin and Hamilton.

THIRD WARD.

31—Pinckney and Wilson.
32—Main and Hancock.
34—Wilson and Blair.

FOURTH WARD.

Box. *Location.*

41—Main, Carroll and Hamilton.
43—Wilson and Broom.
45—West Main, at C., M. & St. P. tracks.
46—Washington Av. and Brooks.

FIFTH WARD.

51—University Av. and Lake.
53—West Johnson and Park.
54—University Av. and Mary.

SIXTH WARD.

61—Main and Blount.
62—Jenifer and Brearly.
64—Jenifer and Baldwin.
65—Winnebago St. and Atwood Av. near Elmside.

INTRUCTIONS FOR OPERATING FIRE ALARM BOX.

Key can be had at any one of the nearest houses to the boxes.

Unlock the door, pull the hook all the way down and let go. Do not jerk the hook down and up, but pull it down steadily as far as you can. Wait at the box until the department arrives, and inform them where the fire is.

The tower bell will strike the number of the box pulled. Thus — for box 34, the bell at the tower will strike and the whistle will blow - - - - - - - three blows, a short pause, then four blows; after which a longer pause. The above will be repeated three additional times. The whistle will give the alarm twice.

Each key is registered. Do not attempt to remove the key; it will be released and returned when the fire is out.

Signals for use of department only are as follows:
Fire out — one tap.
More pressure — two taps.
Second alarm — Two taps repeated.

RULES FOR THE WATER METERS.

The following rules have been adopted by the Board of Water Commissioners, to govern the use of water meters:

SECTION 1. All services which may hereafter be connected with the city Water Works system shall be connected with the meter furnished by the city, if such services shall include sewerage, cesspool or sprinkling of streets or lawns. And all other services and connection shall be so placed that meters can be attached whenever the Board of Water Commissioners may direct it to be done. The water rent wherefore such meter shall have been placed shall be according to the measurement of the meter used. All water meters shall be placed inside of buildings. From and after Jan. 1, 1896 water meters will be placed on all premises that now have the service connection where the present rate of water rent equals or exceeds six dollars ($6) per annum, and in connection with all services used for sprinkling purposes and where yard hydrants are used, and also in connection with such other services where it shall be discovered that there is a constant flow of water, or no meter being used, or as the Board of Water commissioners may from time to time deem proper and necessary. All new water services hereafter made for domestic purposes only shall be so constructed and placed that meters can be readily attached whenever the Board of Water Commissioners may order the same to be done.

SECTION 2. The City of Madison will furnish all meters for one building free to consumers. All meters must be placed by a licensed plumber at expense of property owners, and as near as possible to where service pipe enters building. The plumber doing the work must flush pipe thoroughly before connecting meter. The city will repair all meters that are clogged, and if lead chips are found to be the cause, a fine of $1.00 will be collected from the plumber doing the work for each and every job so found before issuing another permit to said plumber. No water meter shall be removed or disturbed without first having obtained permission from the Superintendent of the Water Works.

SECTION 3. A check and waste shall be placed between the shut-off cock and meter within one foot of the meter. All meters shall be so located and placed as to afford easy access thereto, and so that they can be easily examined and read. In all cases where meters have been ordered and have been supplied, no water from the city Water Works shall be taken, received or supplied to the building for which the same was constructed and intended except that which shall pass through and be registered by such meter.

SECTION 4. The consumers of the water supplied through any water meter shall make all necessary repairs for the proper operation of such water meter, and in case the city of Madison shall deem it necessary and expedient to repair a defective water meter, the expenses of such repair shall be chargeable to such consumers, and shall be paid at the time such repair was made, and in case of failure to pay for such repair, the Superintendent of the Water Works shall shut off the flow of water furnished through such meter.

SECTION 5. In case that any water meter should fail to register the quantity of water passing through the same, the consumers will be charged at the rate of the average daily consumption registered by such meter before the same became out of repair.

SECTION 6. In all cases where one service connection or yard hydrant does supply two or more separate consumers, premises, tenements, business houses or a block occupied by divers parties, one meter only will be placed at the service connection for either or all of said consumers, and the water rent as registered by said meter shall be chargeable to and payable by the owner of said premises or buildings.

SECTION 7. The rate of water rent to be charged where such meters are in use shall be according to the schedule rate established by ordinances, the minimum whereof being in all cases five dollar ($5) per annum.

SECTION 8. Water rents, where meters have been placed, shall be collected for first six months at the schedule rate. Thereafter as per record of meter the preceding six months in a manner as prescribed in section 13 of water works ordinance. No water meter rental will be charged by the city of Madison.

SECTION 9. The Superintendent of the Water Works system, or any person employed by the Board of Water Commissioners, shall be given free and ready access to the premises and buildings for the purpose of examining or repairing any meter or connection therewith. Any and all meters shall be left in the condition and manner as set by the city, and shall not be interfered with in any manner whatsoever.

SECTION 10. In case of any violation of any of the foregoing rules and regulations, the water supply furnished to the consumer guilty of such violation shall immediately be shut off and shall not be resumed except upon a satisfactory adjustment of all the differences connected therewith, and upon the payment of the sum of one dollar for shutting off and turning on the water. Anybody violating any of these rules and regulations shall, upon conviction thereof, be subjected to a fine not to exceed twenty-five dollars ($25), and cost of prosecution.

METER RATES.

6,000 cubic feet or less, per six months, per 100 cubic feet........................						20 cents
Over 6,000 cubic feet and less than 7,000, per six months, per 100 cubic feet....						19 cents
Over 7,000	"	"	8,000,	"	"	18 cents
Over 8,000	"	"	9,000,	"	"	17 cents
Over 9,000	"	"	10,000,	"	"	16 cents
Over 10,000	"	"	16,000,	"	"	15 cents
Over 16,000	"	"	17,000,	"	"	14 cents
Over 17,000	"	"	18,000,	"	"	13 cents
Over 18,000	"	"	19,000,	"	"	12 cents
Over 19,000	"	"	20,000,	"	"	11 cent
Over 20,000	"	"	27,000,	"	"	10 cents
Over 27,000	"	"	28,000,	"	"	9 cents
Over 28,000	"	"	29,000,	"	"	8 cents
Over 29,000	"	"	30,000,	"	"	7 cents
Over 30,000	"	"	60,000,	"	"	6 cents
Over 60,000 cubic feet per six months, per 100 cubic feet..........................						5 cent

Minimum, $5.00 per annum.


MADISON
AND
THE FOUR LAKES.
STATE CAPITOL.
PARK HOTEL.
N
S
W
E
MENDOTA.
FOURTH LAKE
PICNIC POINT
OAK LODGE
STONE FACE
STATE HOSPITAL
GOV'S ISLAND
MAPLE BLUFF
FOX'S BLUFF
WACONIA
BLACK HAWK
EAGLE HEIGHTS
UNIVERSITY BOAT HOUSE
STEAMBOAT DOCKS
MONONA
THIRD LAKE.
ELMSIDE.
TONYAWATHA SPRINGS
WINNEQUAH
EDGEWOOD ACADEMY.
WINGRA
LOUGEE'S SHOOTING BOX.
WAUBESA LODGES
CAMPS AND LODGES
SECOND LAKE.
WAUBESA
BROWN'S BLUFF.
FIRST LAKE.
KEGONSA
SUGAR BUSH
COLLADAY'S POINT
5 MILES FROM CAPITOL.

FOURTEENTH ANNUAL REPORT

..OF THE..

CITY WATER WORKS

MADISON, WISCONSIN

1896

Compliments of

John B. Heim

Superintendent.


FIRE & WATER.

FOURTEENTH ANNUAL REPORT

OF THE

BOARD OF WATER COMMISSIONERS

OF THE

CITY OF MADISON

FOR

THE YEAR ENDING SEPTEMBER 30, 1896,

TOGETHER WITH

THE REPORTS OF SUPERINTENDENT
AND SECRETARY.

MADISON, WISCONSIN:
STATE JOURNAL PRINTING COMPANY,
CITY PRINTERS.
1897.

OFFICERS OF THE WATER WORKS.

JOHN R. MELVIN, PRESIDENT . . .	Term expires October 1, 1898.
J. J. SILBERNAGEL	Term expires October 1, 1897.
J. VAN ETTA	Term expires October 1, 1899.
A. A. DYE	Mayor *ex officio.*
EDWARD QUAMMEN	Alderman *ex officio.*

O. S. NORSMAN, Secretary.

SUPERINTENDENT.

JOHN B. HEIM.

METER INSPECTORS.

NICHOLAS REIF,
FRANK T. HAYES.

ENGINEERS.

PETER GAUER,
H. B. AINSWORTH,
DENNIS DACEY.

FIREMEN.

PATRICK DORIS,
AUSTIN GANNON.

WATER WORKS OFFICE.

City Hall, Second Floor.

Regular Meetings of the Board Wednesday previous to Common Council meeting of each month at 2:30 o'clock P. M.

All Bills against the Department must be rendered on or before the 28th of each month, or they will lay over until the following regular meeting.

Water Rents are due and payable, in advance, at the office of the City Treasurer, on the first days of January and July of each year.

CITY ORDINANCE.

"*All water rents shall be paid semi-annually, the first days of January and July of each year, in advance. Any water rents, whether by schedule or meter*, which shall not be paid within thirty days after the same become due and payable, shall be increased by a penalty of ten per cent., and if the same shall not be paid, together with the penalty thereto attached, within ten days after the same become due and payable, the water shall be shut off from the consumer so in default."

FOURTEENTH ANNUAL REPORT

OF THE

DEPARTMENT OF WATER WORKS

REPORT OF THE COMMISSIONERS.

Office of the
Board of Water Commissioners,
City of Madison, Wisconsin,
February 15, 1897.

To the Honorable Mayor and Common Council of the City of Madison:

We have the honor to submit herewith our Fourteenth Annual Report, being a report of the operation of the Water Works Department for the year ending September 30, 1896.

The Superintendent's report gives a very full account of the operations of the plant, and of the improvements made during the year. Attention is directed to the increased use of water meters during the year. The saving accomplished through the use of meters, not only in the item of expense of pumpage, but also in the equally important saving of the water itself, is fully set forth. With the completion of the meter system, which we expect to realize in the near future, it is confidently expected that still greater saving in this direction will be obtained.

The matter of meter rates is also treated very fully by the Superintendent.

Your careful consideration of these matters, as well as of the report as a whole, is respectfully suggested.

Very respectfully submitted,

John R. Melvin,
J. J. Silbernagel,
J. Van Etta,
A. A. Dye,
Ed. Quammen,
Commissioners.

SECRETARY'S REPORT.

STATEMENT of receipts and expenditures of the Water Works Department of the city of Madison, Wisconsin, for the year ending September 30, 1896:

RECEIPTS.

From water rents	$23,255 49	
From water permits	346 00	
From plumbers' licenses	10 00	
From sale of miscellaneous supplies and meters, extra service connections, etc	314 08	
From tax 1895	10,000 00	
Balance on hand October 1, 1895	1,021 71	

EXPENDITURES.

For construction and extension		$14,073 32
For operating expenses		11,493 56
For repairs		2,233 78
For water rent refunded		18 66
Transferred to sinking fund		5,000 00
Balance on hand October 1, 1896		2,127 96
Total	$34,947 28	$34,947 28

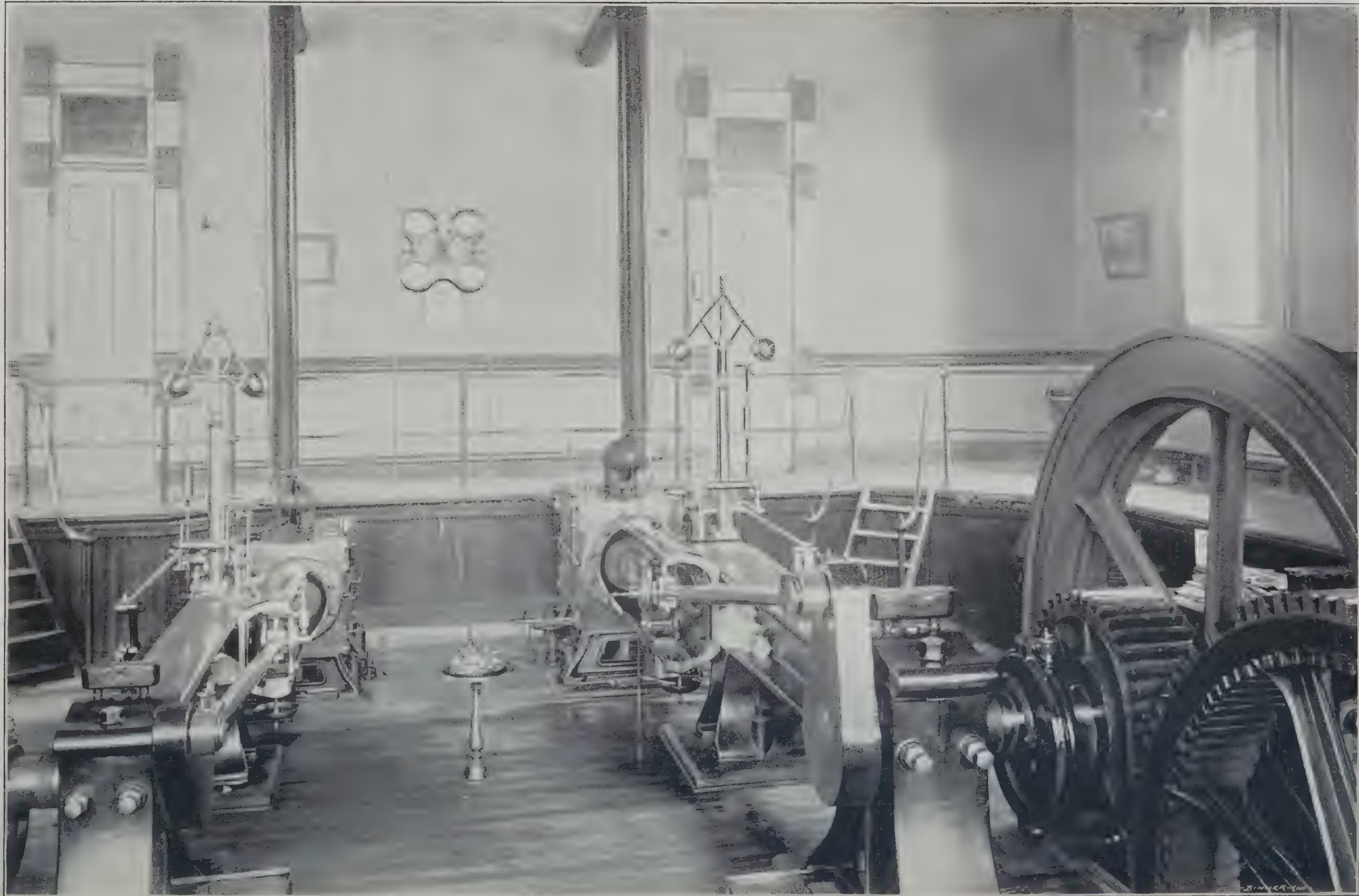
MISCELLANEOUS.

Total receipts for water rents from construction of works to October 1, 1896	$191,099 89
Total receipts from water permits, same period	4,532 00
Total operating expenses to October 1, 1896	129,679 04
Total cost of extension and construction to October 1, 1896 (deducting $10,457.79 error in report for 1893)	300,893 59
Total cost of repairs to October 1, 1896	5,486 78
Amount of bonds issued for construction of works	76,000 00
Amount now outstanding of this issue	8,000 00
Water Works extension bonds issued in 1893	10,000 00
Total amount of water bonds outstanding	18,000 00

Respectfully submitted,

O. S. NORSMAN,

Secretary.



INTERIOR VIEW OF ENGINE ROOM FROM ENTRANCE.

SUPERINTENDENT'S REPORT.

MADISON, WIS., Feb. 1, 1897.

To the Honorable Board of Water Commissioners:

GENTLEMEN:— In compliance with the Water Works ordinance I herewith submit to you the Fourteenth Annual Report of the Water Department, for the year ending September 30, 1896, showing the condition, improvements and progress made during the past year, with such recommendations as are deemed advisable.

CONDITIONS.

The year 1895–96 must be ranked alongside the prosperous years. We have increased our water takers to 2,186, and can safely estimate that we are supplying 12,000 of our inhabitants with water.

We are gradually completing our Meter System — within 460 takers to complete the same,— which can be accomplished this year, and the result as shown by our pumpage record has proved that the enlarging and lowering the suction to the wells was a wise move.

NEW BOILERS.

For better economy and safety, we ought to replace our boilers with a new set, and, if the finances allow, *the present year.*

The three boilers that are now in use have been in over fourteen years, and were able to carry from 100 to 105 pounds pressure when new. We do not carry now more than 70 to 75 pounds, and we are obliged to run two boilers to be ready in case of fire.

I would recommend the purchase of two new boilers of large capacity, to be able to carry from 125 to 150 pounds pressure, enabling us to run one at a time, rated from 100 to 120 horsepower each, in anticipation of modern improved pumping machinery, giving us better duty and higher economy.

NEW SUCTION.

After the completion of the laying of the new 16-inch suction and connecting with the 8-inch well on Blair street, the connection with the 12-inch suction from the 10-inch wells on Livingston and Patterson streets, and the connecting with the 8-inch well on Blount street, the repairing of discovered leaks in several valves and the branches under the street railway track, we still pumped air, despite all examination and repairing. After thorough investigation, we came to the conclusion that the fault was with the old suction between Blount street and the pumping station, and connected with the new at both points. We decided to disconnect the same, and our trouble ceased.

To give the results accomplished through this enlarging and lowering of suction from the wells, after we had all our troubles overcome, I will give the number of gallons of water pumped and the pounds of coal consumed during the five summer months from May 1st to October 1st for the years 1891–96. (We of course must give the meters part of the credit, the increase in pumpage of water in 1885–86 over 1884–85 being 26,252,071 gallons, and an increase of 98,150 pounds of coal during these same months without meters.)

TABLE SHOWING THE RESULTS.

MONTHS.	YEAR.	No. of takers.	No. of meters.	Gallons of water pumped per month.	Pounds of coal consumed per month.
May	1891	1405	498	17,799,500	83,600
June	1891			17,309,000	86,100
July	1891			17,639,500	84,200
August	1891			18,856,950	104,100
September	1891			20,072,000	92,500
Total				91,676,950	450,500
May	1892	1554	547	18,002,250	86,800
June	1892			18,906,250	94,400
July	1892			23,555,450	112,800
August	1892			25,952,000	116,600
September	1892			19,792,500	106,400
Total				106,208,450	517,000
Increase over 1891				14,531,500	66,500

TABLE SHOWING THE RESULTS — CONTINUED.

MONTHS.	YEAR.	No. of takers.	No. of meters.	Gallons of water pumped per month.	Pounds of coal consumed per month.
May	1893	1701	673	24,122,000	122,400
June	1893	....	....	21,933,750	117,400
July	1893	....	....	23,672,000	122,400
August	1893	....	....	26,406,750	106,400
September	1893	....	....	22,968,750	122,200
Total				119,163,250	590,800
Increase over 1892				12,954,800	73,800
May	1894	1820	795	20,624,500	105,800
June	1894	....	....	26,539,250	122,800
July	1894	....	....	34,012,000	131,400
August	1894	....	....	31,118,500	143,200
September	1894	....	....	24,992,000	124,800
Total				137,286,250	628,000
Increase over 1893				18,123,000	37,200
May	1895	1994	1223	26,411,750	123,800
June	1895	....	....	31,646,000	135,000
July	1895	....	....	32,533,500	150,000
August	1895	....	....	31,271,000	141,200
September	1895	....	....	28,688,000	137,400
Total				150,547,250	687,400
Increase over 1894				13,264,000	59,400
May	1896	2186	1726	29,803,250	133,600
June	1896	....	....	26,350,000	116,800
July	1896	....	....	26,061,500	131,400
August	1896	....	....	24,347,000	123,000
September	1896	....	....	23,694,000	123,000
Total				130,255,750	627,800
Decrease over 1895				20,291,500	59,600

Thus you will see that notwithstanding the increase of our water-takers in 1896 (192 greater than in 1895), our pumpage was over 20,000,000 gallons less, and 29½ tons of coal less than in 1895.

The average pumpage in 1895 per day was 982,593 gallons, or 493 gallons per day for each taker; and in 1896 it was only 851,344 gallons per day, or 392 gallons per taker.

The amount of coal consumed per day in 1895 was 4,492 pounds, or $2\frac{504}{1994}$ pounds per taker. In 1896 it was 4,103 pounds, or $1\frac{1917}{2186}$ pounds per taker.

Should you decide, at an early day, on new Compound Condensing Pumping Machinery placed ten and one-half feet lower than that now in use, to meet this suction, we can safely guarantee another fifty per cent. reduction in coal, and an increase of fifty per cent. in water.

The accompanying diagrams show the connections of the new suction main made at the intersection of Johnson and Blount streets, across the street and under the street railway track, to meet the 12-inch suction connecting the 9-inch and 10-inch well and the 8-inch well on Blount street, the lowering of the 12-inch main between Blount and Livingston streets and the main at the Station.

The 16-inch main had to be laid on the opposite side of the street on account of the old suction.

Fig. A. shows the new suction with branches, laid eleven feet deep to connect as stated above.

Fig. B. shows a cross-section of the 12-inch suction on Johnson street, which was connected with the 16-inch suction.

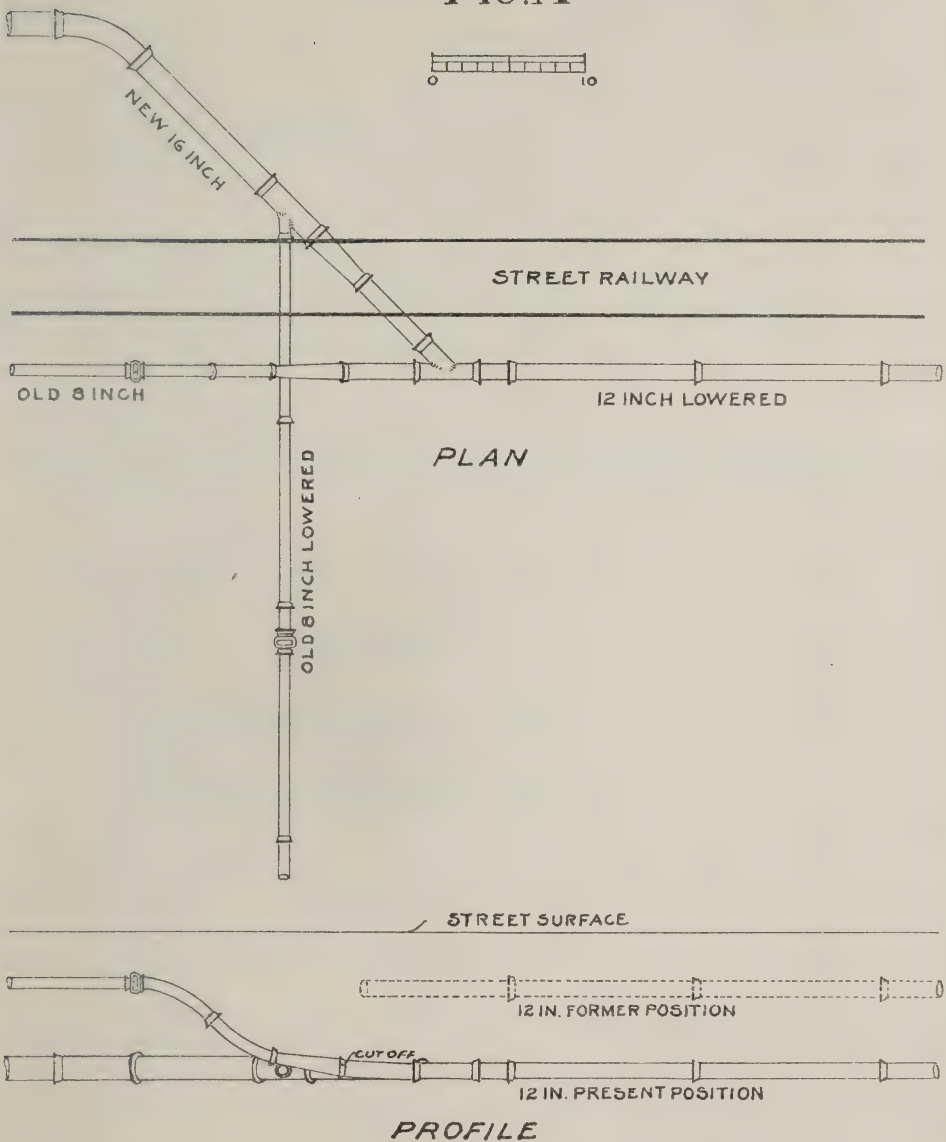
This suction laid according to grade with between three and four feet of covering, and had to be lowered at the connecting point of Blount street 5 feet and 10 inches, down to zero on Livingston street, a distance of 845 feet.

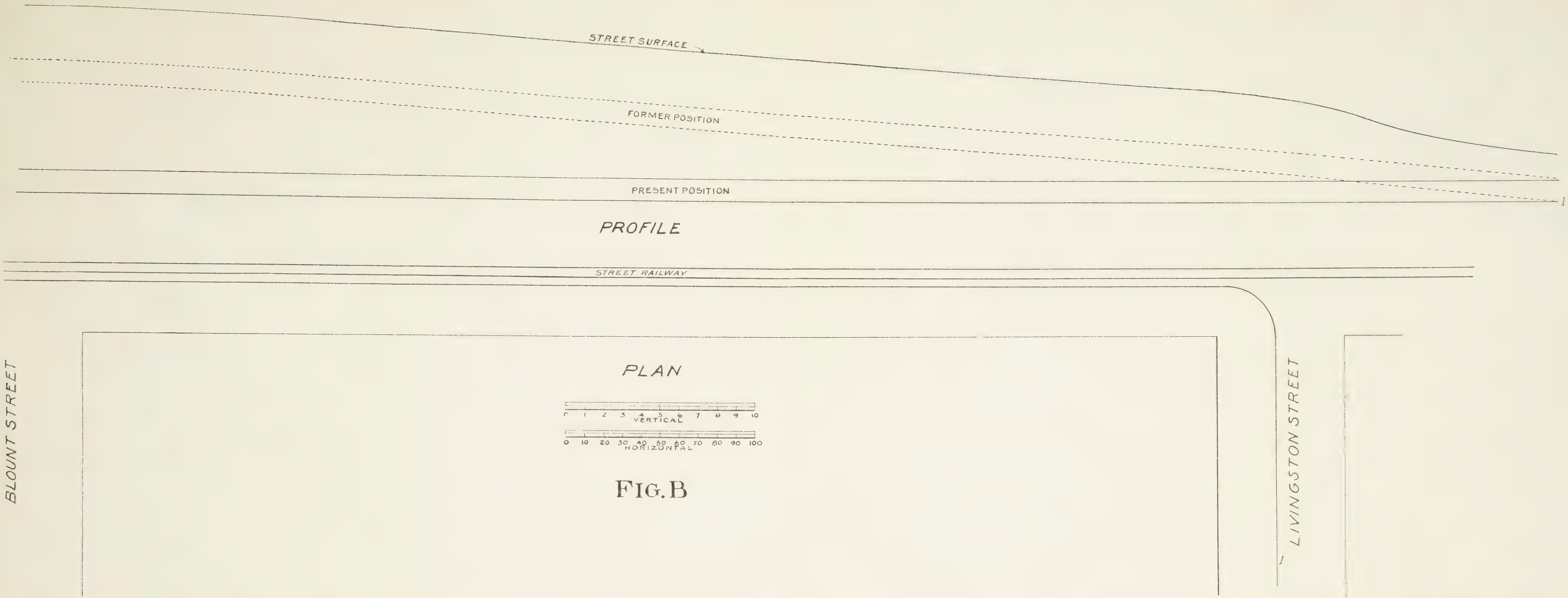
We could not interfere with the supply to the city, and therefore had to lower the main while the supply was being drawn from the wells.

This main weighed, with water passing through it, 112,780 pounds, and had to be lowered without breaking a joint, as that would cut off the supply from the wells.

We lowered this pipe within a given point from where it would be connected with the 16-inch pipe, with eighteen men, in four hours, without breaking a joint, and only had to recaulk a few joints that allowed a little air to ooze through. After we had lowered the main it was not three inches out of place.

FIG. A


0
10
NEW 16 INCH
STREET RAILWAY
OLD 8 INCH
12 INCH LOWERED
PLAN
OLD 8 INCH LOWERED
STREET SURFACE
12 IN. FORMER POSITION
CUT OFF
12 IN. PRESENT POSITION
PROFILE



STREET SURFACE
FORMER POSITION
PRESENT POSITION
PROFILE
STREET RAILWAY
PLAN
BLOUNT STREET
LIVINGSTON STREET
VERTICAL
HORIZONTAL

FIG. B

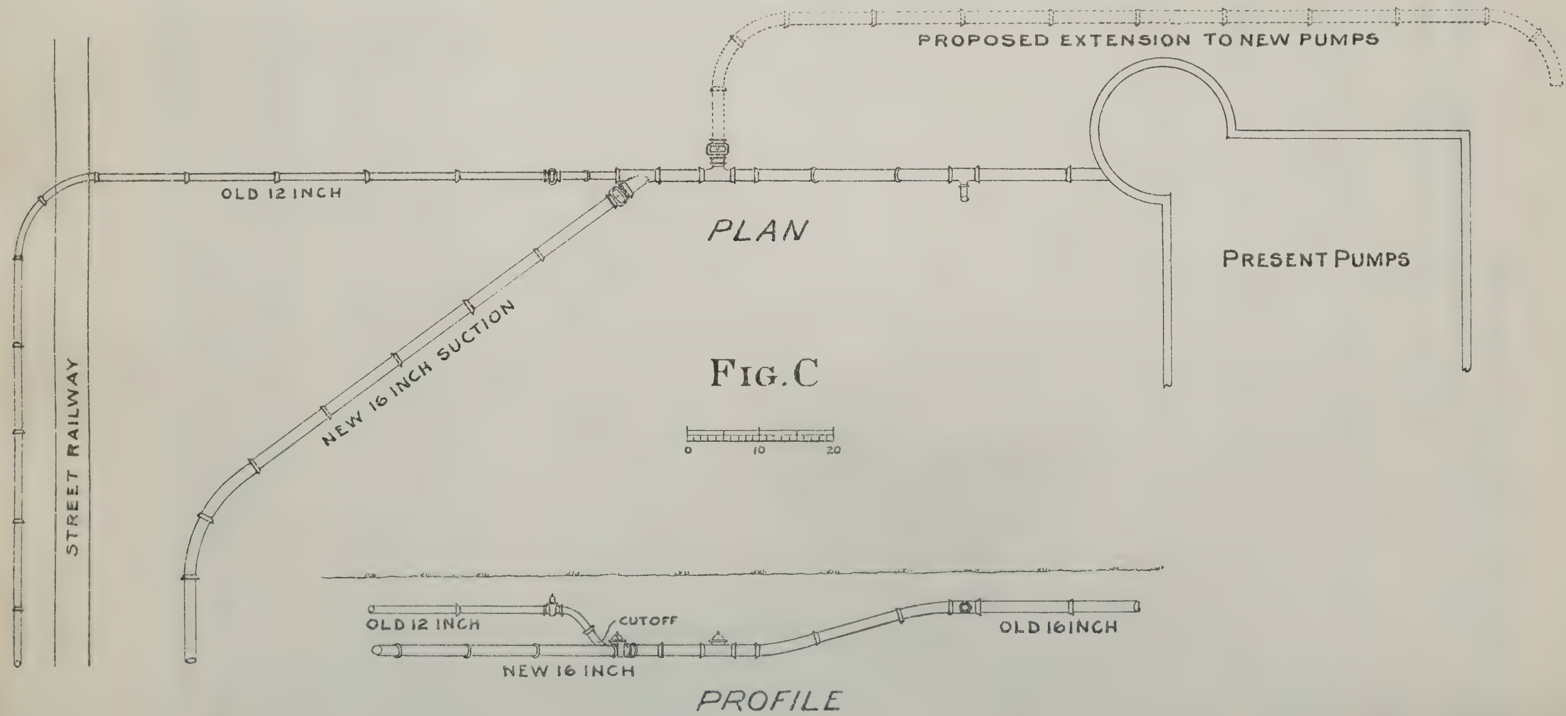

STREET RAILWAY
OLD 12 INCH
NEW 16 INCH SUCTION
PLAN
PROPOSED EXTENSION TO NEW PUMPS
PRESENT PUMPS
0
10
20
OLD 12 INCH
CUTOFF
NEW 16 INCH
OLD 16 INCH
PROFILE

FIG. C

The cost of excavating, lowering main and replacing earth and macadam as good as found was $189.

The final connecting was done on Sunday, when all was connected at once with branches at the intersection and supply cut-off.

Fig. C. shows the old and new 16-inch suction connected with the 12-inch suction now cut off, and the 16-inch valve already placed for the new 16-inch suction to be carried along in front of building to the opposite side of Station to connect with the new pumps when such are placed.

METERS.

We are gradually drawing nearer to the completion of the meter system as the funds allow. During the past year we added 503 meters, against 428 the previous year, making to date 1,726. Should the new consumers increase as they have the past years, we will not be able to complete the system the coming year.

The total amount expended thus far for meters is $31,273,65,—a trifle to what we have gained.

It is always well to compare past years with the present to prove the results we claim.

The amount of water pumped, for each taker, in 1884–85, without the meter system, was 839 gallons. In that year we were still in our infancy. We had only 699 takers, no sprinkling carts, only water for drinking in schools, no sewer system. The estimated free water did not amount to 10,000,000 gallons.

In 1894–95 we had 1,994 water-takers, 1,223 meters, and pumped only 431 gallons for each taker; and the past year (1895–96), with 2,186 water-takers and 1,726 meters, we reduced the pumpage still less, it being 24 gallons, or 407 gallons for each taker per day.

The past two years the estimated free water was 50,250,000 gallons and a sewer system. In 1884–85 we pumped 199,333,840 gallons. In 1895–96, with over two-thirds more takers, we pumped only 325,408,500 gallons of water, and we consumed only 1,558,000 pounds of coal, against 1,210,150 pounds in 1884–85.

The actual saving on coal in 1895–96 over 1894–95, calculating the same pumpage and the price of coal at $4.12 per ton, amounts to $4,590.60, with 1,726 meters.

The saving in 1894–95 was $4,007.94, with 1,223 meters.

The saving in 1893–94 was $3,621.80, with 795 meters.

The saving in 1892–93 was $3,350.97, with 673 meters, and the saving in 1891–92 was $3,123.54, with 547 meters.

Carrying the saving back to 1888, when the meter system was adopted, it would amount to $26,817.95. But as we had to pay as high as $5.95 per ton for coal, the actual saving was $21,655.21.

You will notice that as the meters increase the fuel bill decreases.

After the meter system is complete, we will not only have paid for the meters, but will get interest and more on the investment.

To again show the benefit derived through the meter system, we will compare the years 1894–95 with 1895–96. The amount of water pumped in 1894–95 was 313,705,500 gallons. Of this amount, 86,323,803 gallons passed through the meters, for which the city received $13,373.70, and for the unmetered water, it being 177,131,697 gallons, having deducted 50,250,000 gallons, estimated free water, the city received only $7,182.49.

In 1895–96 we pumped 325,408,500 gallons of water. Of this amount, 107,124,920 gallons passed through the meter, for which the city received $17,168.28, and for the unmetered water, deducting the 50,250,000 gallons of free water, the city received $6,085.21 for 168,033,580 gallons.

The following table shows the number of takers, also meters in use since October 1, 1884, and the amount of water pumped, coal consumed, and the *per capita:*

Year.	No. of takers.	No. of meters.	Gallons water per year.	Gallons water per day.	Pounds coal per year.	Pounds coal per day.	Gals. per capita.
1884–85	699	3	199,333,840	546,120	1,210,150	3,315	48
1885–86	876	5	236,649,850	648,355	1,339,900	3,671	53
1886–87	980	5	261,308,160	715,885	1,124,200	3,123	59
1887–88	1,099	210	257,682,300	704,050	1,047,200	2,861	58
1888–89	1,229	385	195,450,770	535,480	914,500	2,540	44
1889–90	1,355	441	190,810,910	520,030	1,331,500	3,648	43
1890–91	1,405	498	197,889,450	542,162	1,044,000	2,860	38
1891–92	1,554	547	236,035,800	646,753	1,173,100	3,214	47
1892–93	1,701	673	268,246,300	734,921	1,302,200	3,567	50
1893–94	1,820	795	272,006,950	745,224	1,393,800	3,819	48
1894–95	1,994	1,223	313,705,500	859,467	1,514,400	4,152	53
1895–96	2,186	1,726	325,408,500	891,530	1,558,000	4,268	50

These splendid results through the meter system have been accomplished notwithstanding our antiquated, simple, non-

condensing engines, and naturally will be far greater with more modern, improved, compound condensing engines. They would be still better in the item of fuel, if we were not obliged to use hard coal,— the station being located in the residence portion of the city.

The main result, however, obtained through the meter system is the result of our excellent water, additional pumping machinery, better water fixtures, and no diminution in the water pressure of the pipes for extinguishing of fires, there being no unnecessary waste.

NUMBER, SIZE AND KIND OF METERS IN USE OCTOBER 1, 1896.

Size in Inches.	$\frac{5}{8}$	$\frac{3}{4}$	1	2	3
Crown	1,097	68	15	2	....
Hersey	229	128	4	2	....
Thompson	115	......	......	......	....
Union	29	......	......	......	....
Nash	1	2	......	......	....
Worthington	....	2	......	......	1
Trident	3	......	......	......	....
Westinghouse	28	......	......	......	....
Total	1,502	200	19	4	1

Total 1,726

METER RATES.

As stated in my last report a revision of the meter rates ought to be made.

Your honorable body adopted a new revised meter rate last June, under which we collected the water rent last July, it giving general satisfaction. It gives the smaller taker a less rate, the minimum rate having been reduced to $2.25 for six months, and prevents the wasting of water in order to get the benefit of the lesser rate. It is as nearly as possible impartial, compelling all takers, whether large or small, to pay for the first 5,000 cubic feet the same price. A patron who consumes 30,000, 60,000 or 90,000 cubic feet or over must pay for the first 5,000 cubic feet at the rate of 20 cents per 100 cubic feet, the same as the smaller takers.

The meter rate seems to meet the wants of the Water Works

people, as we receive almost daily calls from all over the country for our meter rules and rates, and the flattering comment of having the Model Meter Plant.

Herewith we give the rates per hundred and amount per thousand cubic feet:

First 5,000 cubic feet or less, per six months, per hundred cubic feet, 20 cents.
Over 5,000 cubic feet and up to 20,000 cubic feet, per six months, add $10 for first 5,000 cubic feet and 10 cents for each additional 100 cubic feet.
Over 20,000 cubic feet and up to 30,000 cubic feet, per six months, add $25 for first 20,000 cubic feet and 5 cents for each additional 100 cubic feet.
Over 30,000 cubic feet and up to 60,000 cubic feet, per six months, add $30 for first 30,000 cubic feet and 3 cents for each additional 100 cubic feet.
Over 60,000 cubic feet and up to 90,000 cubic feet, per six months, add $39 for first 60,000 cubic feet and 2 cents for each additional 100 cubic feet.
Over 90,000 cubic feet, per six months, per 100 cubic feet, 5 cents.
Minimum per six months, $2.25.

5,000	cubic feet at	20	cents per 100 cubic feet........	$10 00
6,000	" " "	18.3 and 1-3	" " " " "	11 00
7,000	" " "	17.1 and 1-3	" " " " "	12 00
8,000	" " "	16.2 and 1-2	" " " " "	13 00
9,000	" " "	15.5 and 5-9	" " " " "	14 00
10,000	" " "	15.	" " " " "	15 00
11,000	" " "	14 and 5-11	" " " " "	16 00
12,000	" " "	14.1 and 2-3	" " " " "	17 00
13,000	" " "	13.8 and 6-13	" " " " "	18 00
14,000	" " "	13.5 and 10-14	" " " " "	19 00
15,000	" " "	13.3 and 1-3	" " " " "	20 00
16,000	" " "	13.1 and 1-4	" " " " "	21 00
17,000	" " "	13.	" " " " "	22 00
18,000	" " "	12.7 and 14-18	" " " " "	23 00
19,000	" " "	12.6 and 8-19	" " " " "	24 00
20,000	" " "	12.5	" " " " "	25 00
21,000	" " "	12.1 and 9-21	" " " " "	25 50
22,000	" " "	11.8 and 4-22	" " " " "	26 00
23,000	" " "	11.5 and 5-23	" " " " "	26 50
24,000	" " "	11.2 and 1-3	" " " " "	27 00
25,000	" " "	11.	" " " " "	27 50
26,000	" " "	10.7 and 18-26	" " " " "	28 00
27,000	" " "	10.5 and 15-27	" " " " "	28 50
28,000	" " "	10.3 and 16-28	" " " " "	29 00
29,000	" " "	10.1 and 21-29	" " " " "	29 50
30,000	" " "	10.	" " " " "	30 00
31,000	" " "	9.7 and 23-31	" " " " "	30 30
32,000	" " "	9.5 and 20-32	" " " " "	30 60
33,000	" " "	9.3 and 21-33	" " " " "	30 90
34,000	" " "	9.1 and 6-34	" " " " "	31 20
35,000	" " "	9.	" " " " "	31 50

36,000	cubic feet at	8.8 and 20-36	cents per 100 cubic feet........	$31 80
37,000	“ “ “	8.6 and 30-37	“ “ “ “ “	32 10
38,000	“ “ “	8.5 and 10-38	“ “ “ “ “	32 40
39,000	“ “ “	8.3 and 33-39	“ “ “ “ “	32 70
40,000	“ “ “	8.2 and 20-40	“ “ “ “ “	33 00
41,000	“ “ “	8.1 and 9-41	“ “ “ “ “	33 30
42,000	“ “ “	8.	“ “ “ “ “	33 60
43,000	“ “ “	7.8 and 36-43	“ “ “ “ “	33 90
44,000	“ “ “	7.7 and 2-44	“ “ “ “ “	34 20
45,000	“ “ “	7.6 and 30-45	“ “ “ “ “	34 50
46,000	“ “ “	7.5 and 30-46	“ “ “ “ “	34 80
47,000	“ “ “	7.4 and 32-47	“ “ “ “ “	35 10
48,000	“ “ “	7.3 and 36-48	“ “ “ “ “	35 40
49,000	“ “ “	7.2 and 42-49	“ “ “ “ “	35 70
50,000	“ “ “	7.2	“ “ “ “ “	36 00
51,000	“ “ “	7. and 19-51	“ “ “ “ “	36 30
52,000	“ “ “	7. and 20-52	“ “ “ “ “	36 60
53,000	“ “ “	6.9 and 33-53	“ “ “ “ “	36 90
54,000	“ “ “	6.8 and 48-54	“ “ “ “ “	37 20
55,000	“ “ “	6.8 and 10-55	“ “ “ “ “	37 50
56,000	“ “ “	6.7 and 28-56	“ “ “ “ “	37 80
57,000	“ “ “	6.6 and 48-57	“ “ “ “ “	38 10
58,000	“ “ “	6.6 and 12-58	“ “ “ “ “	38 40
59,000	“ “ “	6.5 and 35-59	“ “ “ “ “	38 70
60,000	“ “ “	6.5	“ “ “ “ “	39 00
61,000	“ “ “	6.4 and 16-61	“ “ “ “ “	39 20
62,000	“ “ “	6.3 and 36-62	“ “ “ “ “	39 40
63,000	“ “ “	6.2 and 54-63	“ “ “ “ “	39 60
64,000	“ “ “	6.2 and 12-64	“ “ “ “ “	39 80
65,000	“ “ “	6.1 and 35-65	“ “ “ “ “	40 00
66,000	“ “ “	6. and 60-66	“ “ “ “ “	40 20
67,000	“ “ “	6. and 20-67	“ “ “ “ “	40 40
68,000	“ “ “	5.9 and 48-68	“ “ “ “ “	40 60
69,000	“ “ “	5.9 and 9-69	“ “ “ “ “	40 80
70,000	“ “ “	5.8 and 40-70	“ “ “ “ “	41 00
71,000	“ “ “	5.8 and 2-71	“ “ “ “ “	41 20
72,000	“ “ “	5.7 and 36-72	“ “ “ “ “	41 40
73,000	“ “ “	5.6 and 52-73	“ “ “ “ “	41 60
74,000	“ “ “	5.6 and 36-74	“ “ “ “ “	41 80
75,000	“ “ “	5.6	“ “ “ “ “	42 00
76,000	“ “ “	5.5 and 40-76	“ “ “ “ “	42 20
77,000	“ “ “	5.5 and 5-77	“ “ “ “ “	42 40
78,000	“ “ “	5.4 and 48-78	“ “ “ “ “	42 60
79,000	“ “ “	5.4 and 20-70	“ “ “ “ “	42 80
80,000	“ “ “	5.3 and 60-80	“ “ “ “ “	43 00
81,000	“ “ “	5.3 and 27-81	“ “ “ “ “	43 20
82,000	“ “ “	5.2 and 76-82	“ “ “ “ “	43 40
83,000	“ “ “	5.2 and 44-83	“ “ “ “ “	43 60
84,000	“ “ “	5.2 and 12-84	“ “ “ “ “	43 80

85,000 cubic feet at	5.1 and 65-85 cents per 100 cubic feet						....	$44 00
86,000 " " "	5.1 and 34-86	"	"	"	"	"	....	44 20
87,000 " " "	5.1 and 3-87	"	"	"	"	"	....	44 40
88,000 " " "	5. and 60-88	"	"	"	"	"	....	44 60
89,000 " " "	5. and 30-89	"	"	"	"	"	....	44 80
90,000 " " "	5.	"	"	"	"	"	....	45 00

MINIMUM RATE.

For several years a cry has gone up, by some dissatisfied patrons, of the unjustness of a minimum meter rate, and like all isms finds its following.

To set matters right and intelligently before a fair-minded public, I think it best to show the reason of this minimum. On the 1st of October, 1895, we had 1,994 water-takers, and on the 1st of October, 1896, we had 2,186. These patrons paid $23,255.49 in water rent. Of these 2,186 takers, 608 paid only at the minimum rate of $4.50 per annum, or $2,736, whereas the other 1,578 takers paid $20,519.49. Of these 608 takers, six consumed less than 100 cubic feet in six months, ranging from 39 to 85 cubic feet, and would have paid to the city at the rate of 20 cents per 100 cubic feet, as follows:

One taker consumed			39 cubic feet		—	$0.08.
"	"	"	47	" "	—	.09.
"	"	"	68	" "	—	.14.
"	"	"	74	" "	—	.15.
"	"	"	80	" "	—	.16.
"	"	"	85	" "	—	.17.

There were 26 takers that consumed during six months between 100 and 200 cubic feet, or from 20 to 40 cents.

65 takers consumed between	200 and 300 cu. ft.	—	40 to 60 cts.	per	six	mos.
63 " " "	300 and 400 "	—	60 to 80 cts.	"	"	"
79 " " "	400 and 500 "	—	80 cts. to $1	"	"	"
56 " " "	500 and 600 "	—	$1.00 to 1.20	"	"	"
83 " " "	600 and 700 "	—	1.20 to 1.40	"	"	"
71 " " "	700 and 800 "	—	1.40 to 1.60	"	"	"
61 " " "	800 and 900 "	—	1.60 to 1.80	"	"	"
37 " " "	900 and 1000 "	—	1.80 to 2.00	"	"	"
61 " " "	1000 and 1100 "	—	2.00 to 2.20	"	"	"

These 608 takers consumed, in one year, 363,221 cubic feet, at the rate of 20 cents per 100 cubic feet. The city would only have received from them $726.44.

But the dissatisfied parties say, "That is all we ought to pay; the city is discriminating against us; the city favors the rich; we ought only to pay for what we use."

Let us see whom the city favors:

The city has laid a main in front of all water-takers, as well as for fire protection, tapped the main and carried the service-pipe, complete, to the curbstone, and furnishes and repairs the water-meter free (except when destroyed by frost) to each premises, and collects no meter rental. This is all done at the general expense of the tax-payers.

The expense of laying the 30 miles and over of water-mains cost, at an average, 85 cents per foot. This includes hydrants, valves, etc.— everything complete.

The average cost of the service-pipe to date, including shut-off box, was 52 cents per foot. The average cost of the meters was $17.75.

The water-takers ought to be willing to pay, in water rent, 5 per cent. on the investment incurred for their convenience.

We will calculate the water-main at 60 cents, allowing 25 cents for the fire protection at a lot frontage of 66 feet, the service for the small taker at $9, and the meter at present cost, $12.75:

Lot front 66 feet, at 60 cents	$39.60, at 5 per cent	$1 98
Service connections	9.00, at 5 per cent	45
Water-meter	12.75, at 5 per cent	64
Total		$3 07

Operating expenses the past year were $11,493.56.

We will calculate by the number of water-takers on the 1st of May, which was 2,040. The average cost to each taker, whether large or small (it requires the same labor to look after each), was $5.63. Add to this the $3.07 and it amounts to $8.70, for which the city received only $4.50 from each of the 608 takers — a deficit of $4.20.

Let us now compare with the seven largest takers — the actual frontage of their property — which is:

1556 feet, at 60 cents	$933.60, at 5 per cent	$46 68
Service connections	16.92, at 5 per cent	85
Average water-meter, present cost	40.00, at 5 per cent	2 00
Operating expenses		5 63
Total		$55 16

These seven patrons consumed, by meter, 3,818,107 cubic feet, and the city received from the same, $1,958.69, an average of $279.81, a surplus of $224.65 from each.

The next suggestion that has been made is that there ought to be a

FLAT RATE.

That is, all ought to pay the same rate.

Let us see what would be the result. Where would the discrimination come here? Would it be fair to collect the same rent? The city, in order to do this, would have to collect at the rate of 12 cents per 100 cubic feet. Without the minimum, the 608 patrons would only pay $435.87, and with a minimum there would be no gain. The seven largest consumers would be obliged to pay $4,581,73 or an average of $654.53. (The Park Hotel, alone, would have to pay, at this rate, $1,059.03.) Could we retain our large consumers; and if the city lost the large consumers, would that not increase the rate for the small consumers?

This explanation ought to be convincing to every fair-minded person.

The endeavor of your honorable body has been, at all times, to treat all patrons, as nearly as possible, impartially, and if the dissatisfied parties will study the rates they will arrive at the same conclusion.

WATER PERMITS.

During the past year we issued 192 original water permits, making the total of takers September 30, 1896, 2,186.

WATER RENTS.

The annual revenue from the 2,186 takers was $23,255.49, permits $346, a total of $23,601.49,—an increase over last year of $2,697.30. The average for each taker was $10.63.

OPERATING EXPENSES.

The operating expenses for the year ending September 30, 1896, were $11,493.56.

We purchased anthracite pea coal, contracted for with Conklin & Sons, they being the lowest bidders, at $4.12 per ton.

The receipts for water rents and permits were $23,601.49, carrying a balance of $12,107.93, an increase over last year of

$4,672.61 (in view of which the meter rates were reduced, taking effect in July, 1896). This surplus was placed in the Construction Fund.

CONSTRUCTION EXPENSES.

The construction, repairs, meters, extensions and improvements for the year ending September 30, 1896, amounted to $16,347.10,— an increase over last year of $2,718.32.

SERVICE CONNECTIONS.

During the past year we laid 4,527 feet of services, which brings the number of feet of service-pipe laid to curbstone to 59,543 feet or 11 $\frac{1683}{5280}$ miles of pipe.

We also laid 1,943 feet of services to curbstone before the streets were macadamized, to prevent tearing up streets when called for. These are not included in the above summing up.

There are now 236 taps and service-pipes to curbstone on macadamized streets, to be connected with when application for water is made, without tearing up the street.

MEASUREMENTS OF SERVICE CONNECTIONS.

The city requires of each plumber, before the return of his work and permit, to place on the permit, where provision is made, the exact measurement of the cut-off box of the service connection with the premises connected with the water-main from a well-defined public place, under section 9 of the Water-works Ordinance.

We often find, in case the cut-off box is covered through grading or sodding having been done without knowledge of the Department, that the measurements are very incorrect and carelessly given.

We have commenced to bring the shut-off boxes that are covered, when laborers have leisure, to the surface, and, when office work allows, to remeasure all services, correct them on the permits, and enter in a special recording book, giving premises by street number, lot and block, so that, in case of transfer of property, we will not be liable to lose track of consumers.

The following tables show on what streets services were laid the past year for new takers and those ready for connection, giving size and number of feet on each street, and the total:

TABLE SHOWING SERVICES LAID FOR NEW TAKERS.

STREETS AND AVENUES.	$\frac{5}{8}$ In.	$\frac{3}{4}$ In.	1 In.	$1\frac{1}{2}$ In.	Total.
Baldwin	48				48
Bassett	200				200
Blount	29				29
Broom	48				48
Brooks	29				29
Bruen	61				61
Carroll	42	29			71
Canal	57				57
Chandler	29				29
Charter	19				19
Clymer	250				250
Dayton	162				162
Fairchild	38				38
Few	57		200		257
Francis	170	75			245
Gilman	67				67
Gorham	136				136
Hamilton	29				29
Hancock	38				38
Henry	48				48
Jane	96				96
Jenifer	136			300	436
Johnson	606				606
Lake	58				58
Langdon	87				87
Livingston	58				58
Main	125		19		144
Mary	19				19
Mifflin	125				125
Mills	69				69
Monona street	13				13
Murray	29				29
Patterson	29				29
Spaight	29				29
State	80				80
University avenue	145				145
Warren			19		19
Washington avenue	241		48		289
Webster	77				77
Williamson	162				162
Wilson	38				38
Wisconsin avenue	58				58
Totals	3837	104	286	300	4527

We also replaced the two-inch wrought iron pipe which was laid during the years 1889–90 with double extra strong lead

pipe, in front of block No. 125 on East Wilson street, the wrought iron pipe having reached the extent of its life with our water.

TABLE SHOWING SERVICES LAID TO CURBSTONE BEFORE MACADAMIZING OF STREETS, TO PREVENT TEARING UP FOR CONNECTION HEREAFTER.

STREETS.	Size.	Number of Taps.	Number of Feet.
Baldwin	$\frac{5}{8}$	3	87
Clymer	$\frac{5}{8}$	11	289
Dayton	$\frac{5}{8}$	20	480
Gorham	$\frac{5}{8}$	11	252
Henry	$\frac{5}{8}$	5	154
Jenifer	$\frac{5}{8}$	6	164
Johnson	$\frac{5}{8}$	9	221
Mary	$\frac{5}{8}$	6	114
Mifflin	$\frac{5}{8}$	8	182
Total	....	79	1,943

NEW MAINS.

During the past year we laid only two branches of 4-inch cast iron pipe and added three valves: 330 feet on Brearly street, between Williamson and Jenifer streets, valve at Williamson street; 390 feet on Brooks street, between Johnson and Dayton streets, valve at Johnson street; and 490 feet on West Dayton street, between Charter and Mills streets, and valve at Charter street.

The total mileage of water mains September 30, 1896, is $30\frac{2595}{5280}$ miles; 150 hydrants, 192 valves, 5,753 feet of suction pipe with 17 valves, and 1,864 feet of lead mains where we were unable to connect into a main for circulation, obviating a dead end.

COMPARISON.

A continuous call is made upon us for the Tenth Annual Report, which gave a comparison of results, to date, of private and municipal ownership of our City Water Works. The copies of the report are exhausted, and as an error had crept into

the table, seemingly increasing our construction expenses, I have prepared a corrected table showing the actual outlay of the city in its construction, from January 1, 1882, to October 1, 1896, the receipts for water rents during the same period, and what the city would have paid in hydrant rental during that time, with five per cent. added in each case.

The endeavor is made to mislead people, that our showing is not correct. The following will give the actual figures and history:

The actual amount borrowed in 1882 was $76,000, at five per cent., on which interest has been paid these fourteen years.

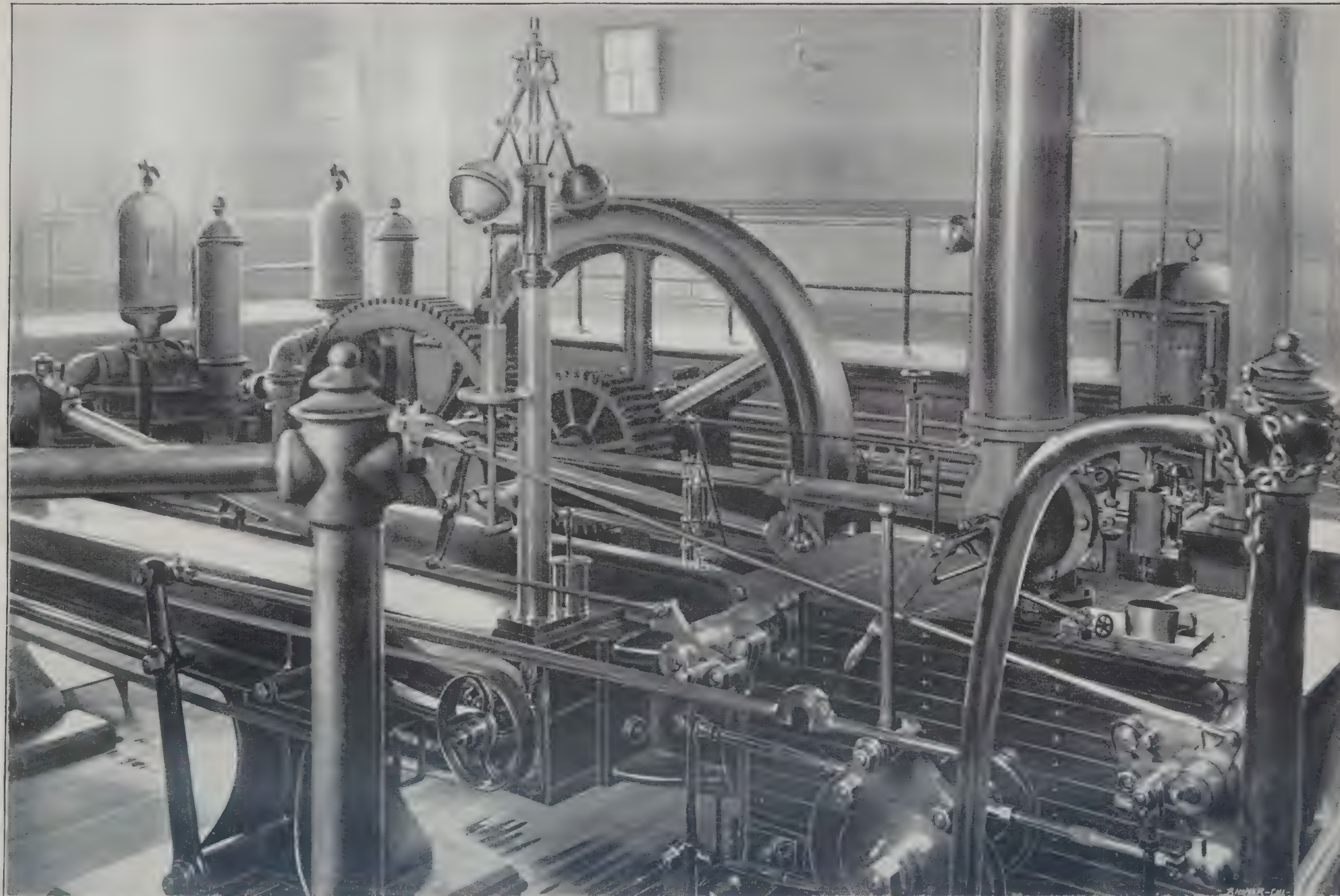
The total amount of bonds still outstanding is $8,000; interest, $400.

This $8,000 will be wiped out the 1st of April, 1897. The balance of expense on construction and extension was all paid in cash by an annual taxation set aside for the Water Works, and the receipts from water rents and permits over and above the operating expenses. The operating expenses are not brought into consideration, as one would offset the other, and would be less by the company, as such is the case everywhere over municipal ownership, but will give them in the following table, showing the operating expenses since construction and per annum:

Year.	Employees.	Salaries.	Cost of coal per ton.	Total operating expenses.
Oct. 1, 1882, to Oct. 1, 1883	Two engineers, two firemen	$3,680	$6 17	$3,942 34
Oct. 1, 1883, to Oct. 1, 1884	Two engineers, two firemen	3,880	5 00	7,901 91
Oct. 1, 1884, to Oct. 1, 1885	Two engineers, two firemen	3,880	4 95	8,543 30
Oct. 1, 1885, to Oct. 1, 1886	Two engineers, two firemen	3,880	4 10	8,135 29
Oct. 1, 1886, to Oct. 1, 1887	Two engineers, two firemen	3,880	6 24	8,739 73
Oct. 1, 1887, to Oct. 1, 1888	Two engineers, two firemen, meter insp.	4,480	8 33	9,188 91
Oct. 1, 1888, to Oct. 1, 1889	Two engineers, two firemen, meter insp.	4,480	5 75	11,735 94
Oct. 1, 1889, to Oct. 1, 1890	Three engineers, no firemen, meter insp.	4,600	*3 14	7,564 25
Oct. 1, 1890, to Oct. 1, 1891	Three engineers, no firemen, meter insp.	4,600	4 10	8,052 24
Oct. 1, 1891, to Oct. 1, 1892	Three engineers, one fireman, meter insp.	5,340	5 95	8,827 90
Oct. 1, 1892, to Oct. 1, 1893	Three engineers, one fireman, meter insp.	5,340	5 95	10,458 79
Oct. 1, 1893, to Oct. 1, 1894	Three engineers, two firemen, meter insp.	6,000	5 27	11,626 01
Oct. 1, 1894, to Oct. 1, 1895	Three engineers, two firemen, meter insp.	6,000	4 12	†13,468 87
Oct. 1, 1895, to Oct. 1, 1896	Three eng., two firemen, two meter insp.	6,600	4 12	11,493 56
Total				$129,679 04

*Soft coal used.

†Includes $2,506.19 paid for the year 1895-96 instead of monthly payments as heretofore.



INTERIOR VIEW OF ENGINE ROOM FROM EAST CORNER.

COMPARISON.

Year.	Amount to be paid to company by city, 5 per cent. added.			Actual outlay by the city in construction during same period, 5 per cent. added.			Receipts for water rents, 5 per cent. added.		
	Cost to city if owned by company.	Interest, 5 per cent.	Total.	City paid for construction.	Interest, 5 per cent.	Total.	Amount rec'd for water.	Interest, 5 per cent.	Total.
1882, Year of constr'n				$47,876 52	$2,393 83	$50,270 35			
Oct. to Oct.		From Jan. 1, '82.							
1882–3	$10,000 00	$833 28	$10,833 28	39,595 32	1,979 77	41,575 09	$3,176 30	$158 81	$3,335 11
1883–4	10,500 00	525 00	11,025 00	42,990 45	2,149 52	45,139 97	7,170 30	358 52	7,528 82
1884–5	11,250 00	562 00	11,812 50	8,471 40	432 57	8,903 97	8,738 06	436 90	9,174 96
1885–6	12,375 00	616 75	12,991 75	17,707 21	855 36	18,592 57	10,715 36	537 77	11,251 13
1886–7	14,000 00	700 00	14,700 00	16,461 48	823 07	17,284 55	13,217 69	660 88	13,878 57
1887–8	14,750 00	737 50	15,487 00	15,294 80	764 74	16,059 54	13,783 40	689 17	14,472 57
1888–9	15,000 00	750 00	15,750 00	18,124 57	906 23	19,030 74	13,410 37	670 52	14,080 89
1889–90	15,250 00	762 50	16,012 50	12,865 37	643 27	13,508 64	13,136 43	656 82	13,793 25
1890–1	15,750 00	787 50	16,537 50	7,551 13	377 56	7,928 69	15,144 26	757 21	15,901 47
1891–2	16,750 00	837 50	17,587 50	14,180 10	709 00	14,889 10	15,020 83	751 04	15,771 87
1892–3	17,600 00	880 00	18,480 00	19,858 88	992 94	20,851 82	16,201 70	810 09	17,011 79
1893–4	17,600 00	880 00	18,480 00	12,927 69	646 38	13,574 07	18,560 44	928 02	19,488 46
1894–5	18,400 00	920 00	19,320 00	12,914 41	645 72	13,560 13	20,556 19	1,027 81	21,584 00
1895–6	18,400 00		18,400 00	14,073 32		14,073 32	23,255 49		23,255 49
Total	$207,625 00	$10,791 95	$217,417 03	$300,892 59	$14,319 96	$315,242 55	$192,086 82	$8,443 56	$200,528 38
Deduct for service connections expended free to taker				$33,679 80					
				$267,212 79					
Deduct for water meters free to taker				31,273 65					
				$235,939 14					
Deduct artesian wells and suction, less $10.000 (see next page at *)				27,241 82					
Bringing our cost to				$208,697 32					
Our surplus over and above operating expenses — From water rent				62,407 82					
				$146,285 50					
From water permits				4,532 00					
Total				$142,753 50					

Minimum water rate was $6.00 till July, 1890; from July, 1890, to July, 1896, $5 00, and now $4.50 per annum under meter rates.

Thus it will be seen that the city would have paid for hydrant rental to the company, under the franchise called for, with five per cent. added since construction, $217,417.03.

It cost the city during the same period to construct, having now 30½ miles of water mains, with five per cent. added, $315,242.55, in which is included $33,679.80 for service connections, and $31,273.65 paid for water meters (no company furnishing these free to takers), a total of $64,953.45. Deducting this amount from the cost of construction, less the five per cent., and it brings the amount to $235,939.14.

Again, the city expended $37,241.82 for artesian wells, and over a mile of suction pipe. The company naturally would have gone to the lake to avoid this expenditure, with an expense of not over $10,000,* bringing our construction down to $208,697.32. The city has also carried the mains to the outskirts for fire protection, with but very little revenue in compensation.

The city received from water rents during this same period, with five per cent. added, $200,528.38. Deduct this amount from the construction, $315,242.55, and it would leave only $114,714.17, against $217,417.03 which the city would have paid to the company. On the other hand, with our low water rent, calculating on the expenditure of $208,697.32, the construction would have been brought down to $9,719.71 by the company — nearly wiped out — while the expense with the city would increase year by year, and the city would still own nothing.

The total actual net receipts, without any percentage, were $192,086.82.

The total actual operating expenses were $129,679.04, a net gain of $62,407.82.

The interest paid on the bonds was $36,775.

A surplus remains of $25,632.82, being a net earning of over eight per cent. on the construction.

The net earnings the past year from water rents and permits, after paying five per cent. interest on the remaining original and the new issue of bonds and on the construction, were over three and one-half per cent.

With the company, this saving would have been, with a higher water rate and less operating expenses, at the least calculation eight per cent.

Fortunately, the city owns its water works, and the citizens reap the benefit.

The city is its own master, and whenever the conditions allow, the water rents are reduced for the benefit of its patrons.

Our minimum meter rate is $4.50 per annum, against $10 and over by companies. There are only 3 out of 194 cities, officially given, where the rate is as low or lower than ours, but their fuel bill is considerably cheaper, as we are obliged to use hard coal.

The City of Madison can certainly feel proud of its Water Works, its efficiency and magnitude ranking it among the foremost of the country, and can be thankful to those who had the wise forethought to keep the works under her own control. She has a plant that is not purchasable at any price, and at a very conservative estimate is worth a million dollars.

MANAGEMENT.

We have now completed the fourteenth year of the existence of our Water Works, the pride of our beautiful city.

Your honorable body intrusted with its management can well feel repaid by the success achieved through your arduous zeal, diligence and faithful endeavors to carry on the successful work, and your efforts ought to meet the highest encomiums of our citizens.

I have endeavored to conduct the work intrusted to me by your honorable body in a business-like manner, impartially and fearlessly, with the interests of the city always in view, which the results prove, and I shall continue to conduct the same in like manner as long as you desire to intrust us with the management. In

CONCLUSION,

allow me to express my gratitude to each member of the Board for the wise counsel and kind aid cheerfully given, and for confidence reposed.

I desire also to express my satisfaction to the Secretary, Meter Inspectors, Chief Engineer and Assistants, Firemen and Laborers, for the ever-willing, prompt and faithful discharge of their respective duties in their aim for the success of the *Madison City Water Works.*

Respectfully submitted,

JOHN B. HEIM,

Superintendent.

PUMPAGE.

Monthly Record of the Amount of Water Pumped and Coal Consumed During the Year.

Prepared by Chief Engineer Peter Gauer.

Months.	Gallons of water pumped.	Revolution of large engine.	Revolution of small engine.	Average steam pressure.	Average water pressure.	Average vacuum.	Pounds of coal consumed.	Net cumbustibles.	Ashes.	Duties in foot lbs per 100 lbs. net cumbustibles.
October, 1895	32,813,000	1,491,000	....	70	85	20	150,400	126,336	24,064	44,105,684
November, 1895	27,885,000	1,267,500	....	70	85	18	130,200	109,200	20,800	45,755,225
December, 1895	26,203,500	974,000	385,000	70	85	18	128,500	107,930	20,570	43,521,375
January, 1896	30,054,750	1,200,500	291,500	70	85	20	139,500	117,190	22,310	46,095,140
February, 1896	23,730,750	108,500	1,707,500	70	85	17	122,100	102,564	19,536	41,371,590
March, 1896	29,464,000	862,000	840,000	70	85	19	131,400	110,376	21,024	47,861,719
April, 1896	25,001,750	389,000	1,315,500	70	85	18	117,600	98,784	18,816	45,311,035
May, 1896	29,803,250	688,500	1,172,500	70	85	19	133,600	112,224	21,376	47,681,784
June, 1896	26,350,000	....	2,108,000	70	85	18	127,500	107,100	20,400	44,057,370
July, 1896	26,061,500	42,000	2,011,000	70	85	18	131,400	110,376	21,024	42,265,420
August, 1896	24,347,000	351,000	1,330,000	70	85	17	123,000	103,320	19,680	42,088,185
September, 1896	23,694,000	652,000	748,000	70	85	17	123,000	103,320	19,680	40,846,180
Total	325,408,500	8,026,000	11,909,000	70	85	$18\frac{3}{12}$	1,558,000	1,308,520	249,480	Av. 44,246,725

RECORD OF FIRES DURING THE YEAR.

Date.	Time.	Duration.	Gallons of water pumped for fire.	Pressure at station in pounds.	False Alarm.	No. of box.
Oct. 13, 1895..	7 p. m.	1 hour.	24,000	90–100	....	61
Oct. 13, 1895..	7:50 p. m.	....	....	....	No water	51
Nov. 2, 1895..	10:40 a. m.	....	....	....	No water	26
Nov. 4, 1895..	12:55 a. m.	40 m.	6,000	80–90	....	34
Nov. 27, 1895..	3:10 p. m.	45 m.	12,000	80–100	....	28
Nov. 30, 1895..	4:20 p. m.	....	....	....	No water	61
Dec. 3, 1895..	10:30 p. m.	....	....	....	No water	41
Dec. 14, 1895..	4:55 p. m.	....	....	....	No water	61
Jan. 1, 1896..	2 p. m.	10 m.	2,000	90	....	21
Jan. 3, 1896..	4:30 p. m.	....	....	....	No water	16
Jan. 10, 1896..	11:55 a. m.	....	....	....	No water	18
Jan. 10, 1896..	9:30 a. m.	....	....	....	No water	34
Jan. 14, 1896..	9:17 p. m.	....	....	....	No water	14
Feb. 16, 1896..	1:45 p. m.	20 m.	7,000	80–100	....	46
Feb. 20, 1896..	9:25 a. m.	....	....	....	No water	41
Feb. 28, 1896..	7:50 p. m.	40 m.	14,000	78–85	....	51
Feb. 29, 1896..	9:45 p. m.	4:25 m.	98,000	80–95	....	62
Mar. 2, 1896..	10:10 p. m.	....	....	....	No water	53
Mar. 4, 1896..	7:30 p. m.	12 m.	5,000	80–100	....	45
Mar. 6, 1896..	8:10 p. m.	30 m.	10,000	80–100	....	45
Mar. 8, 1896..	1:30 a. m.	40 m.	14,000	85–100	....	14
Mar. 9, 1896..	12:45 p. m.	....	....	....	No water	34
Mar. 28, 1896..	2:30 a. m.	20 m.	4,000	85–100	....	54
Mar. 30, 1896..	12:05 a. m.	....	....	....	No water	31
April 4, 1896..	8:25 a. m.	15 m.	3,000	85–90	....	63
April 8, 1896..	6:50 p. m.	....	....	....	No water	41
April 15, 1896..	6:50 p. m.	....	....	....	No water	41
April 15, 1896..	7:55 p. m.	....	....	....	No water	12
April 23, 1896..	3:05 p. m.	....	....	....	No water	21
April 29, 1896..	12:45 p. m.	40 m.	6,000	85–90	....	54
May 14, 1896..	6:20 p. m.	....	....	....	No water	64
May 18, 1896..	11 a. m.	....	....	......	No water	26
June 23, 1896..	11:40 p. m.	....	....	....	No water	51
July 11, 1896..	7:10 p. m.	1:50 m.	52,000	78–80	....	34
July 22, 1896..	10:35 a. m.	20 m.	4,000	80–90	....	26
July 23, 1896..	3:20 a. m.	10 m.	5,000	90–100	....	26
July 24, 1896..	1:30 a. m.	....	....	....	No water	31
July 30, 1896..	11 a. m.	....	....	....	No water	51
Aug. 1, 1896 .	5:45 p. m.	40 m.	35 400	100–105	....	3 & 23
Aug. 2, 1896..	9:45 p. m.	1:30 m.	18,000	85–100	......	16
Aug. 11, 1896..	7:30 p. m.	....	....	....	....	43
			317,400			

SUMMARY OF STATISTICS.

REPORT OF 1895 AND 1896.

CITY WATER WORKS, MADISON, DANE COUNTY, WISCONSIN.

Population by census, 1895	15,950.
Date of construction	1881–1882.
By whom owned	City of Madison.
Source of supply	10 Artesian wells.
Mode of supply	The water is drawn direct from the artesian wells up to a distance of 5,010 feet from station.
1. Pumping machinery	Reynolds-Corliss engine with Knowles pump combined.
2. Description of coal used	Anthracite pea.
Price per ton	$4.12.
3. Coal consumed for the year in lbs.	1,558,000.
4. Total pumpage for the year in gallons	325,408,500.
5. Average static head against which pumps work	197.
6. Average dynamic head against which pumps work	215.25.
7. Duty in foot pounds per 100 pounds of coal net combustible, making no deduction for starting, banking fires, heating building or anything else	44,246,725.

8. Cost of pumping, figured on pumping expenses, including cost of fuel, salaries, etc., cutting lawn and shoveling snow	$11,493.56.
9. Per million gallons raised one foot high (dynamic)	$16\frac{402}{1000}$.
10. Net cost of works to date	$300,892.59.

Consumption.

1. Estimated population	17,884.
2. Estimated population supplied	12,000.
3. Total number of gallons pumped per year	325,498,500.
4. Average daily consumption	891,530.
5. Number of takers	2,186.
6. Number of meters	1,726.
7. Average gallons pumped per day for each taker	407.
8. Average gallons pumped per day *per capita*	50.

Distribution.

Mains.

1. Kind of pipe used	Cast iron.
2. Size	From 4 to 16 inches.
3. Total miles of main	$30\frac{2595}{5280}$ miles.
4. Total hydrants	150.
5. Total valves	192.
6. Total miles of service (lead)	$11\frac{1683}{5280}$ miles.
7. Total feet of cast iron suction pipe	6,279.

Analysis of Water.

Potassium sulphate	.0237.
Sodium sulphate	0.286.
Sodium phosphate	Trace.
Bi-carbonate of soda	1.094.
Bi-carbonate of lime	15.234.
Bi-carbonate of magnesia	12.984.
Bi-carbonate of iron	0.214.
Sexqui-oxide of aluminum	Trace.
Silica	0.414.
Sodium chloride	0.292.
Organic matter	None.
Total solid contents per gallon	30.755.

Invoice of Pipe-yard and Specials.

84 feet of 16-inch cast-iron pipe.
6 feet of 14-inch cast-iron pipe.
170 feet of 12-inch cast-iron pipe.
66 feet of 10-inch cast-iron pipe.
18 feet of 8-inch cast-iron pipe.
40 feet of 6-inch cast-iron pipe.
847 feet of 4-inch cast-iron pipe.
84 feet of 3-inch cast-iron pipe.
One 16x16x4x4 cross.
One 16x16x8 tee.
One 16-inch cap.
One 12x12x12 tee.
One 8x8x8 tee.
One 4x4x4x4 cross.
One 4x4x4 tee.
One 4x4x3 tee.
One 4x4x2 tee.
One 8 to 6 reducer.
One 8 to 4 reducer.
Three 6-inch offsets.
Three 6-inch plugs.
One 4-inch 45° elbow.
One 4-inch 90° elbow.
One 16-inch sleeve.
Two 14-inch sleeves.
Three 12-inch sleeves.
Three 10-inch sleeves.
Five 8-inch sleeves.
Four 6-inch sleeves.
Nine 4-inch sleeves.
Two 3-inch sleeves.
Two 2-inch sleeves.
Two 5-inch hydrants.
Five 4-inch hydrants.
Six 5-inch hydrant rods with valve attached.
Six 4-inch hydrant rods with valve.
One sprinkling crane.
One Nye pump.
One trench pump.

FIRE ALARM.

Signals of the fire alarm from bells and whistle are as follows, and is same number of blows as number of box:

SIGNAL BOXES.

Box. *Location.*

3 — Fuller & Johnson W'ks, 3 blows.

FIRST WARD.

12 — Wisconsin Av. and Gorham St.
14 — State, Gilman and Broom.
16 — Mifflin and Broom.
18 — State and Fairchild.

SECOND WARD.

21 — Washington Av. and Canal St.
23 — Dickinson and Dayton.
24 — Johnson and Few.
26 — Johnson and Patterson.
27 — Gorham and Butler.
28 — Pinckney, Mifflin and Hamilton.

THIRD WARD.

31 — Pinckney and Wilson.
32 — Main and Hancock.
34 — Wilson and Blair.

FOURTH WARD.

Box. *Location.*

41 — Main, Carroll and Hamilton.
43 — Wilson and Broom.
45 — West Main, at C., M. & St. P. tracks.
46 — Washington Av. and Brooks St.

FIFTH WARD.

51 — University Av. and Lake St.
52 — State and Park.
53 — West Johnson and Park.
54 — University Av. and Mary St.

SIXTH WARD.

61 — Main and Blount.
62 — Jenifer and Brearly.
63 — Williamson and Livingston.
64 — Jenifer and Baldwin.
65 — Winnebago St. and Atwood Av., near Elmside.

INSTRUCTIONS FOR OPERATING FIRE ALARM BOX.

Key can be had at any one of the nearest houses to the boxes.

Unlock the door, pull the hook all the way down and let go. Do not jerk the hook down and up, but pull it down steadily as far as you can. Wait at the box until the department arrives, and inform them where the fire is.

The tower bell will strike the number of the box pulled. Thus — for box 34, the bell at the tower will strike and the whistle will blow - - - - - - - three blows, a short pause, then four blows; after which a longer pause. The above will be repeated three additional times. The whistle will give the alarm twice.

Each key is registered. Do not attempt to remove the key; it will be released and returned when the fire is out.

Signals for use of department only are as follows:

Fire out — one tap.

More pressure — two taps.

Second alarm — two taps repeated.

RULES FOR THE WATER METERS.

The following rules have been adopted by the Board of Water Commissioners, to govern the use of water meters:

SECTION 1. All services which may hereafter be connected with the City Water Works system shall be connected with the meter furnished by the city, if such services shall include sewerage, cesspool or sprinkling of streets or lawns. And all other services and connection shall be so placed that meters can be attached whenever the Board of Water Commissioners may direct it to be done. The water rent wherefore such meter shall have been placed shall be according to the measurement of the meter used. All water meters shall be placed inside of buildings. From and after January 1, 1896, water meters will be placed on all premises that now have the service connection where the present rate of water rent equals or exceeds five dollars ($5) per annum, and in connection with all services used for sprinkling purposes, and where yard hydrants are used, and also in connection with such other services where it shall be discovered that there is a constant flow of water, or no meter being used, or as the Board of Water Commissioners may from time to time deem proper and necessary. All new water services hereafter made for domestic purposes only shall be so constructed and placed that meters can be readily attached whenever the Board of Water Commissioners may order the same to be done.

SECTION 2. The City of Madison will furnish one meter for one building free to consumers. All meters must be placed by a licensed plumber at expense of property owners, and as near as possible to where service pipe enters building. The plumber doing the work must flush pipe thoroughly before connecting the meter. The city will repair all meters that are clogged, and if lead chips are found to be the cause, a fine of $1 will be collected from the plumber doing the work for each and every job so found before issuing another permit to said plumber. No water meter shall be removed or disturbed without first having obtained permission from the Superintendent of the Water Works.

SECTION 3. A check and waste shall be placed between the shut-off cock and meter, within one foot of the meter. All meters shall be so located and placed as to afford easy access thereto, and so that they can be easily examined and read. In all cases where meters have been ordered and have been supplied, no water from the City Water Works shall be taken, received or supplied to the building for which the same was constructed and intended except that which shall pass through and be registered by such meter.

SECTION 4. The consumers of the water supplied through any water meter shall make all necessary repairs for the proper operation of such water meter, and in case the City of Madison shall deem it necessary and expedient to repair a defective water meter, the expense of such repair shall be chargeable to such consumers and shall be paid at the time such repair was made, and in case of failure to pay for such repair, the Superintendent of the Water Works shall shut off the flow of water furnished through such meter.

SECTION 5. In case any water meter should fail to register the quantity of water passing through the same, the consumers will be charged at the rate of the average daily consumption registered by such meter before the same became out of repair.

SECTION 6. In all cases where one service connection or yard hydrant does supply two or more separate consumers, premises, tenements, business houses or a block occupied by divers parties, one meter only will be placed at the service connection of either or all of said consumers, and the water rent as registered by said meter shall be chargeable to and payable by the owner of said premises or buildings.

SECTION 7. The rate of water rent to be charged where such meters are in use shall be according to the schedule rate established by ordinances, the minimum whereof being in all cases two dollars and twenty-five cents ($2.25) per six months.

SECTION 8. Water rents, where meters have been placed, shall be collected for first six months at the schedule rate; thereafter as per record of meter the preceding six months in a manner as prescribed in section 13 of water works ordinance, for each building, premises or consumer. No water meter rental will be charged by the City of Madison.

SECTION 9. The Superintendent of the water works system, or any person employed by the Board of Water Commissioners, shall be given free and ready access to the premises and buildings for the purpose of examining or repairing any meter or connection therewith. Any and all meters shall be left in the condition and manner as set by the city, and shall not be interfered with in any manner whatsoever.

SECTION 10. In case of any violation of any of the foregoing rules and regulations, the water supply furnished to the consumer guilty of such violation shall immediately be shut off, and shall not be resumed except upon a satisfactory adjustment of all the differences connected therewith, and upon the payment of the sum of one dollar for shutting off and turning on the water. Anybody violating any of these rules and regulations shall, upon conviction thereof, be subjected to a fine not to exceed twenty-five dollars ($25), and the cost of prosecution.

METER RATES.

First 5,000 cubic feet or less, per six months, per hundred cubic feet, 20 cents.

Over 5,000 cubic feet and up to 20,000 cubic feet, per six months, add $10 for first 5,000 cubic feet and 10 cents for each additional 100 cubic feet.

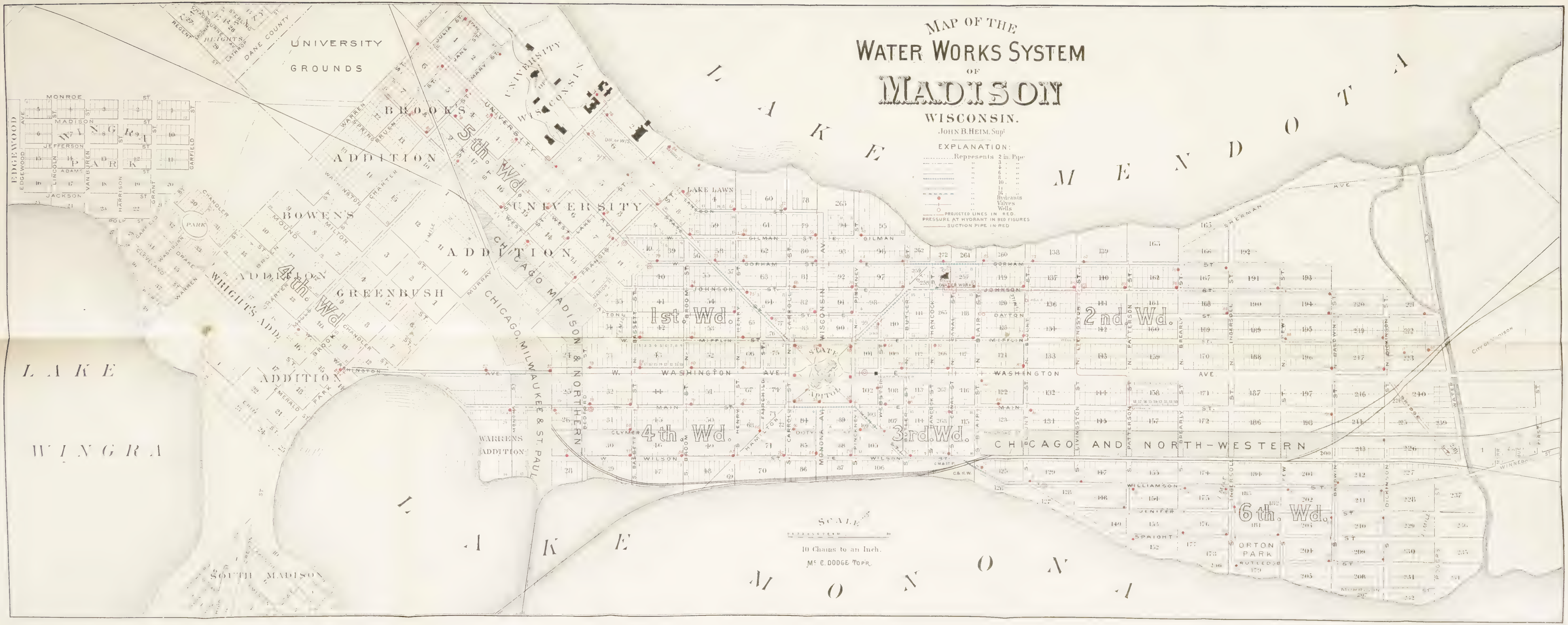
Over 20,000 cubic feet and up to 30,000 cubic feet, per six months, add $25 for first 20,000 cubic feet and 5 cents for each additional 100 cubic feet.

Over 30,000 cubic feet and up to 60,000 cubic feet, per six months, add $30 for first 30,000 cubic feet and 3 cents for each additional 100 cubic feet.

Over 60,000 cubic feet and up to 90,000 cubic feet, per six months, add $39 for first 60,000 cubic feet and 2 cents for each additional 100 cubic feet.

Over 90,000 cubic feet, per six months, per 100 cubic feet, 5 cents.

Minimum per six months, $2.25.



MAP OF THE
WATER WORKS SYSTEM
OF
MADISON
WISCONSIN.
JOHN B. HEIM, Supt
EXPLANATION:
Represents 2 in. Pipe
Hydrants
Valves
Wells
PROJECTED LINES IN RED.
PRESSURE AT HYDRANT IN RED FIGURES
SUCTION PIPE IN RED
SCALE
10 Chains to an Inch.
Mc C. DODGE Topr.
LAKE MENDOTA
LAKE MONONA
LAKE WINGRA
UNIVERSITY GROUNDS
UNIVERSITY OF WISCONSIN
BROOKS ADDITION
UNIVERSITY ADDITION
BOWEN'S ADDITION
GREENBUSH ADDITION
WRIGHT'S ADD.
WINGRA PARK
WARREN'S ADDITION
SOUTH MADISON
LAKE LAWN
ORTON PARK
STATE CAPITOL
WATER WORKS
PARK
1st. Wd.
2nd. Wd.
3rd. Wd.
4th. Wd.
5th. Wd.
6th. Wd.
CHICAGO AND NORTH-WESTERN
CHICAGO MILWAUKEE & ST PAUL
CHICAGO MADISON & NORTHERN
GILMAN ST.
GORHAM
JOHNSON ST.
DAYTON
MIFFLIN ST.
WASHINGTON AVE.
MAIN
WILSON
WILLIAMSON ST.
JENIFER
SPAIGHT
RUTLEDGE
MONROE
JEFFERSON
JACKSON
EDGEWOOD AVE.
SHERMAN AVE.
DANE COUNTY

15th

Annual Report

of the

Bd. of Water Commissioners

of

Madison

for the

Year Ending Sept. 30, 1897

Compliments of

John B. Heim

Superintendent.

WATER WORKS PUMPING STATION.

FIFTEENTH ANNUAL REPORT

OF THE

Board of Water Commissioners

OF THE

City of Madison

For the Year Ending September 30, 1897,

TOGETHER WITH

Reports of the Superintendent and Secretary.

MADISON, WIS.:
DEMOCRAT PRINTING COMPANY, CITY PRINTER,
1898.

LIST OF WATER COMMISSIONERS.[1]

Under whose charge the water works was placed, and time served.

COMMISSIONERS.

James Conklin	1884–5–6–7–8–9
H. Christoffers	1884–5–6–7–8–9–90–1–2–3–4
R. M. Bashford[2]	1884–5–6
John Lamont[3]	1886–7–8–9–90–1–2–3
A. Donovan	1889–90–1–2
John R. Melvin	1892–3–4–5–6–7
W. W. Warner	1893–4–5–6
J. J. Silbernagel	1894–5–6–7
J. Van Etta	1896–7

Ex-officio.

H. N. Moulton,[4] Mayor	1885–6	W. H. Rogers, Mayor	1891–92–93
A. Donovan, Alderman	1885–6	H. Schulkamp, Alderm'n	1891–92–93
E. W. Keyes, Mayor	186–87	John Corscot, Mayor	1893–4
M. J. Cantwell, Alderman	1886–7	R. F. Taylor, Alderman	1893–4
James Conklin, Mayor	1887–8	John Corscot, Mayor	1894–5
G. J. Corscot, Alderman	1887–8	W. C. Noe, Alderman	1894–5
M. R. Doyon, Mayor	1888–9	Jabe Alford, Mayor	1895–6
S. G. Oakey, Alderman	1888–9	W. H. Lansing, Alderman	1895–6
M. R. Doyon, Mayor	1889–90	A. A. Dye, Mayor	1896–7
E. L. Baker,[5] Alderman	1889–90	Edward Quammen, Alderman	1896–7
F. C. Sheasby,[6] Alderman	1889–90		
R. M. Bashford, Mayor	1890–91	M. J. Hoven, Mayor	1897
H. Schulkamp, Alderman	1890–91	Edward Quammen, Alderman	1897

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[1] First commissioners elected April 15, 1884.

[2] Resigned March 1st, 1886.

[3] Elected to fill vacancy.

[4] Mayor and alderman ex-officio added to Board April, 1885.

[5] Resigned.

[6] Elected to fill vacancy.

OFFICERS OF THE WATER WORKS.

JOHN R. MELVIN, PRESIDENT . . .	Term expires October 1, 1898.
J. J. SILBERNAGEL.	Term expires October 1, 1900.
J. VAN ETTA	Term expires October 1, 1899.
M. J. HOVEN	Mayor *ex officio*.
EDWARD QUAMMEN	Alderman *ex officio*.

O. S. NORSMAN, SECRETARY.

SUPERINTENDENT,
JOHN B. HEIM.

METER INSPECTORS,
NICHOLAS REIF,
FRANK T. HAYES.

ENGINEERS,
PETER GAUER,
H. B. AINSWORTH.
DENNIS DACEY.

FIREMEN,
PATRICK DORIS.
AUSTIN GANNON.

WATER WORKS OFFICE,

CITY HALL, SECOND FLOOR.

Regular meetings of the board Wednesday previous to common council meeting of each month at 3 o'clock p. m.

All bills against the Department must be rendered on or before the 28th of each month, or they will lay over until the following regular meeting.

Water rents are due and payable, in advance, at the office of the City Treasurer, on the first days of January and July of each year.

CITY ORDINANCE.

"*All water rents shall be paid semi-annually, the first days of January and July of each year in advance; any water rents, whether by schedule or meter* which shall not be paid within thirty days after the same become due and payable, shall be increased by a penalty of ten per cent., and if the same shall not be paid, together with the penalty thereto attached, within ten days after the same become due and payable, the water shall be shut off from the consumer so in default."

REPORT OF THE COMMISSIONERS.

OFFICE OF THE
BOARD OF WATER COMMISSIONERS,
CITY OF MADISON, WIS., MARCH 1ST, 1898.

To the Honorable Mayor and Common Council of the City of Madison:

We have the honor to submit herewith our fifteenth annual report, covering the operations of the water works department of this city, for the year ending September 30th, 1897.

The replacing of the three old boilers at the pumping station with two large water tube boilers of modern construction, constitutes the principal improvement made in the water works plant since our last report. While this improvement was not made within the period covered by our present report, the work is completed at the date of this writing, and is considered by the superintendent in his report submitted herewith. The cost of this improvement is $3,500. Aside from the fact that fifteen years of continual hard service had left the old boilers in such condition that their safety might well be questioned, it is confidently expected that the new boilers will show such a marked saving in the item of fuel, that there can, as it appears to us, be no doubt of the wisdom of making this change at this time.

Another improvement at the pumping station is the installation of an incandescent electric lighting plant for lighting said building. This involved an expenditure of $600, and we have every reason to be, not only satisfied, but gratified with the results obtained in our efforts to have this departement do its own lighting.

The meter system, while not actually completed, is practically so, there being now only 263 water-takers without meter, out of a total of 2,334 takers. These comparatively few consumers on old services will be gradually supplied with meters in the near future, and on all new services meters will invariably be continued to be placed.

It is gratifying to note that the reduction in water rates has not materially lessened the water rent collections, which leads us to hope that it may ere long be possible to still further reduce and equalize these rates.

The operations of the department are treated very exhaustively by the superintendent and we beg to bespeak for his report your most careful perusal and consideration.

Respectfully submitted,

John R. Melvin,
J. J. Silbernagel,
J. Van Etta,
M. J. Hoven,
Ed. Quammen,
Board of Water Commissioners.

SECRETARY'S STATEMENT.

Receipts and expenditures of the Water Works Department of the city of Madison, Wis., for the year ending September 30th, 1897.

RECEIPTS.

Water rents	$21,471 64	
Water permits	256 00	
Plumbers' license	5 00	
Extra meter and services	71 32	
Meter repairs	37 80	
Lead pipe and lead sold	66 34	
Old material sold	10 50	
Tax of 1896	10,000 00	
Balance Oct. 1, 1896	2,127 96	

EXPENDITURES.

Construction and extensions		$13,358 29
Operating expenses		8,781 13
Repairs		842 81
Water rent refunded		34 13
Meter returned		9 00
Transferred to sinking fund		5,000 00
Balance Oct. 1, 1897		6,021 20
Totals	$34,046 56	$34,046 56

MISCELLANEOUS.

Total receipts for water rents from construction of works to October 1, 1897	$212,571 53
Total receipts from water permits, same period	4,788 00
Total operating expenses to October 1, 1897	138,460 17
Total cost of extension and construction to October 1, 1897	314,251 88
Total cost of repairs to October 1, 1897	6,329 59
Amount of bonds issued for construction of works	76,000 00
Amount now outstanding of this issue	8,000 00
Water Works extension bonds issued in 1893	10,000 00
Total amount of water bonds outstanding	18,000 00

Respectfully submitted,

O. S. NORSMAN,

Secretary.

SUPERINTENDENT'S REPORT.

MADISON, WIS., Feb. 15, 1898.

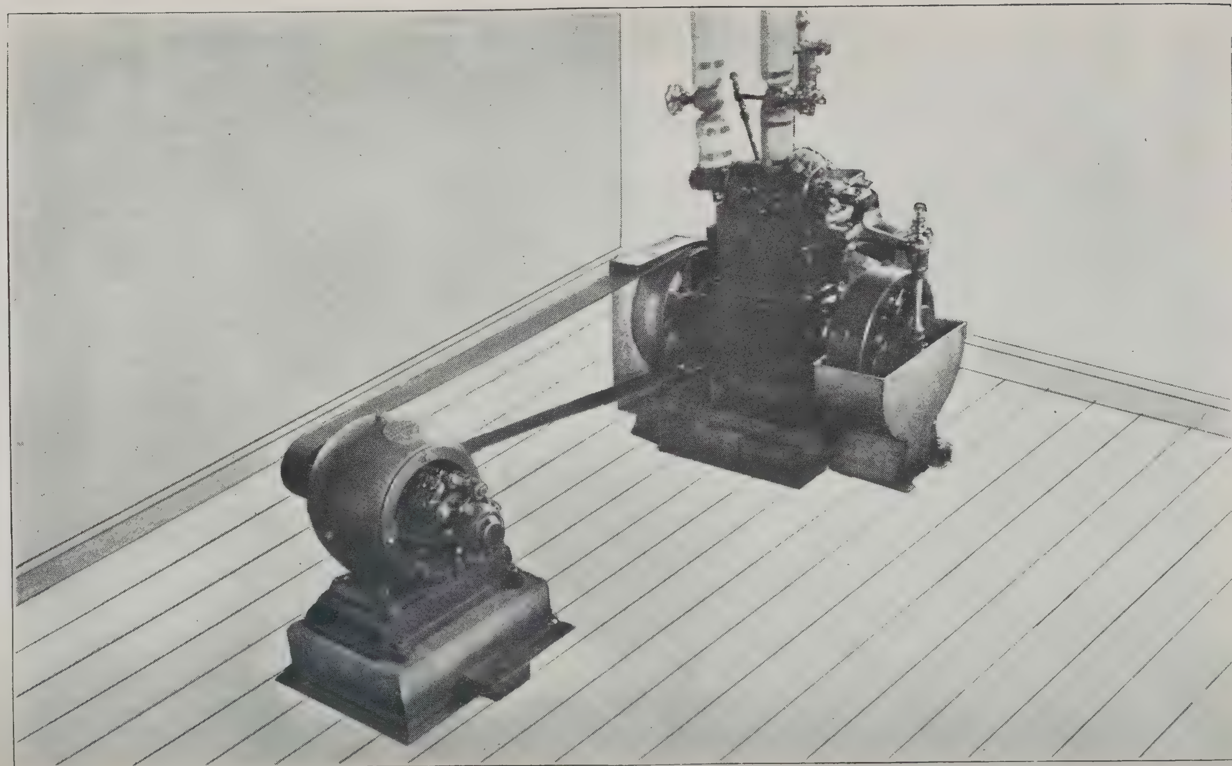
To the Honorable the Board of Water Commissioners:

GENTLEMEN:— Pursuant to the provision of the Ordinance of Water Works, I herewith present the fifteenth annual report of the department for the year ending September 30, 1897, upon the condition of the plant, the additions, improvements, extensions and progress made, the satisfactory financial results, together with such recommendations deemed advisable:

FINANCIAL.

Our financial condition ought to be a great satisfaction to our citizens and meet with their highest encomium. Today we have a plant worth at least treble its cost, which was at the end of our fiscal year including repairs $320,581.47; of this amount only $76,000 was borrowed at 5 per cent. per annum, the balance was all paid in cash specially provided for by the charter from taxation and the net receipts from water rents. From an original indebtedness of $76,000 we have reduced it down to $8,000. The interest on these $76,000 bonds at 5 per cent. per annum for these fifteen years would have amounted to $57,000; whereas we have paid (having commenced to pay off the bonds in 1890), only $39,925, a saving of $17,075. During these fifteen years since construction, our net receipts over and above operating expenses, including permits, have been $78,899.36.

In 1892 through the over-anxiety for the macadamizing of our streets no provision was made for the annual aid to the construction fund, the additional storage building, two



ELECTRIC LIGHT PLANT.

rtesian wells, air chamber and enclosure for same to engine room being under construction, compelled the Water Board to ask the city to borrow an additional $10,000, extension bonds, so, that our total indebtedness to-day is $18,000. Adding the $1,800 in interest paid the past four years for these $10,000 bonds and deducting all interest paid since construction from the net receipts it still shows a surplus of $37,174.36.

The question has been raised time and again, that the present generation ought not to pay all its own created indebtedness of the water works, but to place the burden on the next generation. This is all wrong; each generation has all the burden it can carry. The interest on the bonds in the twenty years would have amounted to $76,000, the amount of the original bonds; whereas today the annual interest is only $400 on the original instead of $3,800 and $450 on the extension bonds of 1893. This indebtedness has been carried off unbeknown to our citizens, notwithstanding that all water mains and service connections are laid, and meters furnished free, and the schedule and meter rates have been gradually reduced. Your honorable body with this splendid showing decided not to call on the city for any aid for the construction fund this coming year, believing that the net receipts over the operating expenses will be sufficient to pay for the construction, extensions and improvements of 1897–98, a *very rare occurrence.*

ELECTRIC LIGHT.

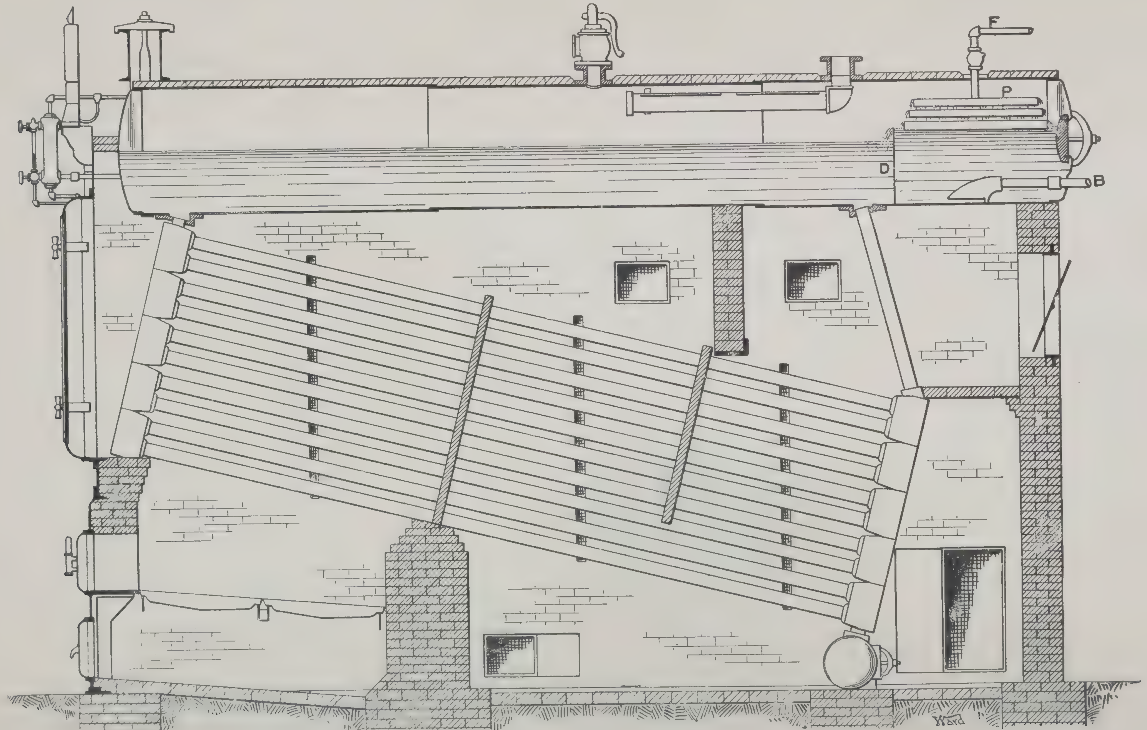
The illuminating of the pumping station being very unsatisfactory and expensive, over $250.00 per annum for only five burners naturally dimly lighted, your honorable body decided to install an electric light plant of 50 incandescent 16 c. p. lamps. The plant cost $600 and consists of one Westinghouse Junior engine, a Northern electric motor, furnished by the Northern Electric Motor Co., of our city, and a marble switchboard, with volt and ammeter, and the necessary wiring: switching, etc., furnished by F. R. Eastman of our city. The cost of running the plant is virtually

nominal, consisting mainly in the replacing of the lamps, the engine being self-oiling, using the oil over and over again, making that item very inexpensive and the illumination is almost as bright as day, and the fuel bill is not noticeable. This is a very good investment and the plant will have paid for itself in less than three years.

NEW BOILERS.

According to my recomendations in last report you decided to place two new water tube boilers in pumping station, engaged Prof. Storm Bull, M. E., of the state university of Wisconsin as the consulting engineer and to prepare plans and specifications.

The contract was awarded to the Standard Boiler Co. of Chicago, Ill. The boilers are of the water tube type of 130 H. P. each. Each contains 64 inch tubes 18 feet long connected with a steam drum 36 inch x 22½ feet long, including purifier. The grate surface is 30 square feet, the heating surface 1,262 square feet, each boiler was tested to 225 pounds hydraulic pressure, before being walled up. The contract price is $3,500 including mason work with extra heavy piping and necessary connections and the covering of same with asbestos, new steel breeching, hard brick floor laid in cement, everything complete and included the removing of the three old boilers. Great credit is due to the chief engineer and his assistants in the splendid condition we found the old boilers, with hardly a trace of scale. As a boiler compound we use sal soda. The new boilers will be run at 80 pounds pressure, but for future use can be run to 125 pounds pressure.



SIDE ELEVATION OF WATER TUBE BOILER WITH PURIFIER.

BOILER TEST.

TEST OF TWO OF THE OLD BOILERS.

1. Date of test	Nov. 5, 6, 1897.
2. Duration of test	24 hours.
3. No. of boilers tested	2.
4. Grate surface	25 sq. ft.
5. Water heating surface	756 sq. ft.
6. Ratio of (4) to (5) =	1 : 52.4.
7. Average steam-pressure	69.9 lbs.
8. Atmospheric pressure	14.7 lbs.
9. Force of draught	.369 lbs.
10. Average temperature of escaping gases	208.7° F.
11. Average temperature of feed water	170.1° F.
12. Total coal consumed	4,500 lbs.
13. Total ash	541 lbs.
14. Total combustible	3,959 lbs.
15. Coal consumed per hour	188 lbs.
16. Quality of steam	98.6 per cent.
17. Moisture in steam	1.4 per cent.
18. Water pumped into boiler	41,674 lbs.
19. Equivalent water evaporated into steam from and at 212° F.	43,030 lbs.
20. Equivalent water evaporated into dry steam from and at 212° F. per hour	1,790 lbs.
21. Water actually evaporated per lbs. of coal	8.9 lbs.
22. Equivalent water evaporated from and at 212° F. per lbs. of coal	9.56 lbs.
23. Equivalent water evaporated from and at 212° F. per lbs. of combustible	1.08 lbs.
24. Coal burned per sq. ft. of grate per hour	3.76 lbs.
25. Water evaporated from and at 212° F. per sq. ft. of heating surface per hour	1.19 lbs.
26. Average horse power, on the basis of 34.5 lbs. of water evaporated from and at 212° F. per hour	52 H. P.

NEW BOILERS.

CAPACITY TEST OF ONE OF THE NEW BOILERS.

1. Date of test	Mch. 21, 1898.
2. Duration of test	3 hours.
3. No. of boilers tested	1
4. Grate surface	30 sq. ft.
5. Water heating surface	1262 sq. ft.
6. Ratio of (4) to (5)	1:42
7. Average steam pressure	8.17 lbs.
8. Atmospheric pressure	1.46 lbs.
9. Average force at draught	447 lbs.
10. Average temperature of escaping gases	442° F.
11. Average temperature of feed water	1,657° F.
12. Total coal consumed	1,635 lbs.
13. Total ash	185 lbs.
14. Total combustible	1,450 lbs.
15. Coal consumed per hour	545 lbs.

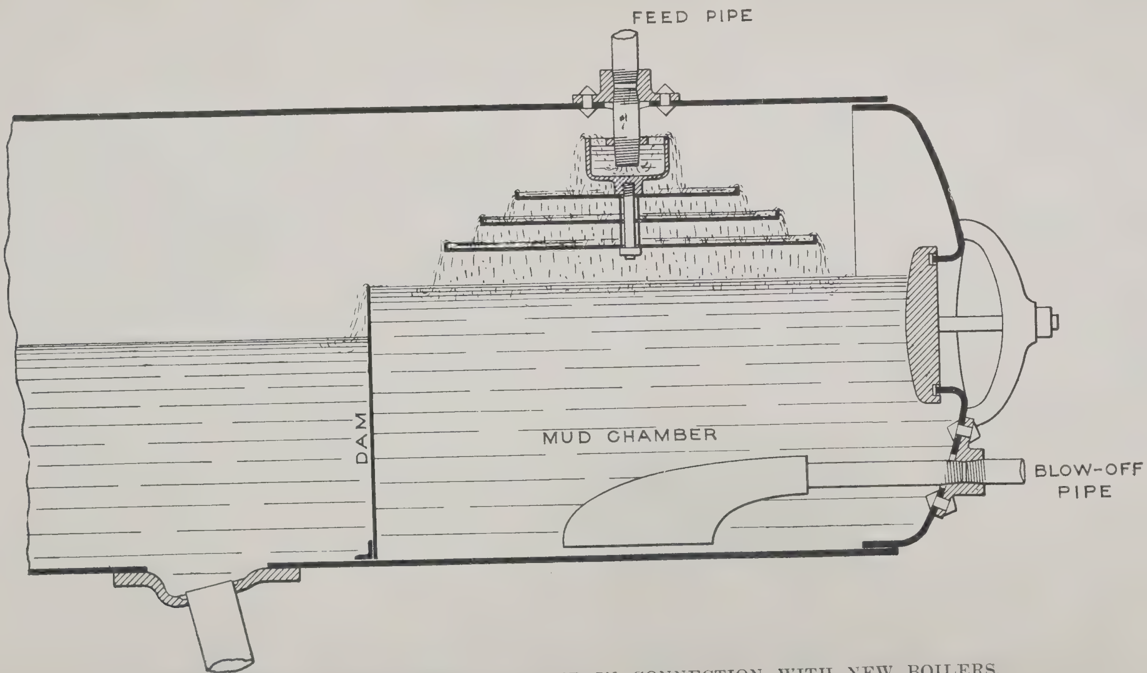
16. Quality in steam	991 pr. ct
17. Moisture of steam	.9 pr. ct.
18. Water pumped into boiler	13,187 lbs.
19. Equivalent water evaporated into dry steam from and at 212° F	14,202 lbs.
20. Equivalent water evaporated into dry steam from and at 212° F per hour	4,734 lbs.
21. Water actually evaporated per lbs. of coal	8.07 lbs.
22. Equivalent water evaporated from and at 212° F. per lbs. of coal	8.63 lbs.
23. Equivalent water evaporated from and at 212° F. per lbs. of combustible	9.79 lbs.
24. Coal burned per square foot of grate per hour	16.11 lbs.
25. Equivalent water evaporated from and at 212° F. per square foot of heating surface per hour	3.76 lbs.
26. Average horse power on the basis of 34.5 lbs. of water evaporated from and at 212° F. per hour	138 H. P.

ECONOMY TEST OF ONE OF THE NEW BOILERS.

1. Date of test	Mar. 21, 1898.
2. Duration of test	6 hours.
3. No. of boilers tested	1.
4. Grate surface	30 sq. ft.
5. Water heating surface	1,262 sq. ft.
6. Ratio of (4) to (5)	1.42
7. Average steam pressure	89.7 lbs.
8. Atmospheric pressure	14.6 lbs.
9. Average force of draught	.47 lb.
10. Average temperature of escaping gases	367° F.
11. Average temperature of feed water	172.6° . F.
12. Total coal consumed	1,844 lbs.
13. Total ash	280 lbs.
14. Total combustible	1,564 lbs.
15. Coal consumed per hour	307.3 lbs.
16. Quality of steam	99.1 per cent.
17. Moisture in steam	.9 per cent.
18. Water pumped into boiler	18,244 lbs.
19. Equivalent water evaporated into dry steam from and at 212° F	19,521 lbs.
20. Equivalent water evaporated into dry steam from and at 212° F per hour	3,253 lbs.
21. Water actually evaporated per lbs. of coal	9.9 lbs.
22. Equivalent water evaporated from and at 212° F. per lb. of coal	10.59 lbs.
23. Equivalent water evaporated from and at 212° F. per lbs. of combustible	12.46 lbs.
24. Coal burned per square ft. of grate	10.2 lbs.
25. Equivalent water evaporated from and at 212° F. per square ft., of heating surface per hour	2.58 lbs.
26. Average horse power on the basis of 34.5 lbs. of water evaporated from and at 212° F. per hour	94.3 H. P.

One-half hour before beginning each test the fire was cleaned and the ashes were removed from pit, and one-half hour before the close of the test the fire was again cleaned, and the ashes were removed and weighed.

Readings of pressures and temperatures were taken every fifteen minutes.



SIDE VIEW OF LIVE STEAM PURIFIER IN CONNECTION WITH NEW BOILERS.

The readings of the calorimeter for finding the moisture in the steam were taken every half hour.

At the end of the tests the fire was in the same condition as at the beginning, and the level of the water and the pressure of the steam were also the same as at the beginning.

As the consumption of steam was very constant during the test a run of 6 hours was deemed sufficient to get accurate results. The test of the old boilers was made when the pumping engines were running at their every-day rate, whereas during the test of the new boiler the engines in both cases were running faster than it ordinarily does. This was done in order that the boilers might be tested for capacity in the first test, and in the second test so that it might be worked at near its rated capacity, which is about twice of what is needed for the ordinary running of the pumps.

CONTINUOUS GROWTH.

On the 30th of September our water takers had increased to 2,334, being 148 additional added during the year. There is not a building erected but a call for city water comes with it, and gradually private wells are being abandoned. Every new taker must place a meter.

During the year we extended the water mains one and a half miles, placed eight hydrants and seventeen valves and added 345 meters.

IMPROVEMENTS.

Of these seventeen valves, four were placed to divide the original districts into smaller fields, to inconvenience our patrons as little as possible, when we are obliged to cut off the water in case of a leak, repairing of hydrants or laying of mains; they were placed as follows: On the northeast side of Livingston street on Gorham street; on the east side of Mills street on University avenue; on the east side of Mills street on Johnson street; on the north side of Mound street on Mills street. During the coming season we expect to place a valve on Johnson and Few streets and Ingersoll and Spaight streets.

METERS.

We expected to complete the meter system during the past year but there being so much call for additional mains and extensions, we were unable to accomplish that end. With less money at command this coming year (waiving any aid from the city for the construction fund) we cannot accomplish that long desired result. There are still 263 meters to be placed on old services.

During the year we placed 148 meters on new services and 197 on old services, a total of 345, against 503 of last year. Total connected to date 2,071.

The total amount expended up to September 30, 1897, for meters is $38,008.85. I can not refrain from lauding the meter system, the great results we have obtained. The great dilemma of a water supply we escaped by its adoption at so small an expense and a greater increase in water takers. A great many of our citizens hesitated in connecting with the city water supply, preferring their wells, for fear we would connect with Lake Mendota or succeed in another supply out from the city, and in doubt as to its wholesomeness. What an enormous expense that would have been, not calculating on the additional pumping machinery from time to time and rather an increase in the water rates than a reduction in rates as already given. We were threatened with a continuous fear of shortage of water, but the meters have banished all that.

It is a gratifying pleasure in looking back comparing with every year of the existence of the water works to note the inroad we have made, as soon as the meter system was adopted, in checking the waste of water. We will compare 1886–7 (when we adopted the inspection system endeavoring to check the enormous waste that was going on which led the following year to the adoption of the "general meter system)," with the past year of 1896–7.

Before proceeding, will state, that while the free water in 1886–7, we could not estimate beyond 35,000,000 gallons, no street sprinkling by carts being done and no sewer

system; the estimated free water in 1896–7 would amount to 131,000,000 gallons used through the syphons at hydrants of the East Washington Avenue sewer; sewer flush tanks; and part of street sprinkling for which the department received no pay, aside from the free water, of the public buildings.

COMPARISON.

The entire quantity of water pumped as calculated from the engine counter in 1886–7, with 980 takers, was 261,308,160 gallons; in 1896–7, with 2,334 takers, 290,972,750 gallons; in 1886–7 we had five meters; in 1896–7 we had 2,071.

The daily average in pumping for the two hottest and two coldest months in 1886–7 was for December, 1886, 823,135 gallons; January, 1887, 756,450 gallons; July, 1887, 781,919 gallons; August, 1887, 836,048 gallons. In 1896–7 (with the continuous flow through the syphon on East Washington avenue) it was December, 1896, 777,177 gallons; January, 1897, 821,226 gallons; July, 1897, 898,226 gallons, and August, 1897, 715,726 gallons. In the last named month the syphon on East Washington avenue was discontinued.

Will also compare the last three years: In 1894–5, with 1,994 takers, 1,223 meters, we pumped 313,705,500 gallons, an average of 859,467 gallons per day and 431 gallons for each taker. In 1895–6, with 2,186 takers, 1,726 meters, we pumped (including sewer syphon) 325,408,500 gallons, an average of 891,530 gallons per day, and 407 gallons for each taker, 24 gallons less than in '94–95. In 1896–7 (syphon partly cut off), with 2,334 takers, 2,071 meters, we pumped 290,972,750 gallons of water, an average of 797,186 gallons per day, and 393 gallons for each taker per day, 14 gallons less than in 1895–6. In 1895–6, we consumed 779 tons of coal; in 1896–7, 44 tons less, namely, 735; whereas in 1886–7, with 980 takers, the daily average in pumpage was 715,855 gallons or 725 gallons for each taker, 332 gallons more than the past year. The amount of coal consumed in pounds in 1886–7 was 1,124,200 or 1,147 pounds for each taker.

In 1896–7 the total amount of coal was 1,470,600 pounds

or 630 pounds to each taker. The assertion that as the meter system increases, the fuel bill decreases, is verified from year to year by the records.

During the past year 89,555,415 gallons of water passed through the meters for which the city received $18,110.82, against $17,168.28 last year. Of the 2,071 patrons that received their water through the meter, there were one that consumed over 600,000 cubic feet, three over 400,000 cubic feet, one over 300,000 cubic feet, seven over 200,000 cubic feet, seven over 100,000 cubic feet, 56 from 20,000 to 100,000 cubic feet, 58 from 5,000 to 20,000 cubic feet during six months, 1,938 that paid the 20 cent rate for the year; of these 546 paid only the minimum rate of $4.50 per annum amounting to $2,457.00.

These 546 takers actually consumed by meter measurement 671,412 cubic feet, which would mean only an average of $2.46 per annum or $1,342.82.

Of these 546 takers, 110 consumed only 59,212 cubic feet during the year or $1.07 per annum. Of the 110 takers eleven consumed number of cubic feet *during the year* as follows: one taker 190 cubic feet, 38 cents; one 198, 40 cents; one 209, 42 cents; one 290, 58 cents; one 312, 62 cents; one 315, 63 cents; one 334, 67 cents; one 367, 73 cents; two 368, 74 cents; one 380, 76 cents; one 414, 83 cents. Of these 110 takers, eight consumed number of cubic feet during *six months* as follows: One 47 cubic feet, 9 cents; one 73, 15 cents; one 76.15 cents; one 77, 15 cents; two 90, 18 cents; one 96, 19 cents. This readily proves what would be the result if we had no minimum rate, and to what extent the stinting in water would lead to, in a great many cases detrimental to health and a higher meter rate.

The exigent expenses must be met and 38–48–58 cents, $1.07 or $2.46 per annum is not a fair compensation for services rendered, it costs as much to take care of a small as of a large consumer.

Still there are some takers that object to the scale and minimum rate; they want a flat, a frigid, an absolute, instead of a uniform rate, and the minimum abolished. The tendency of all of us, is to get as much as possible for as

little or nothing, from the city, state, etc., forgetting, that if there is a shortage, we will have to meet the expense in another way, and eventually costs us more.

Our rates are arranged so, that no taker need stint himself in the use of water, the minimum rate is fixed at $2.25 per six months to encourage the plentiful usage to the extent of one and two-fifths barrel of water a day.

Every consumer whether large or small must pay the same rate for the first 5,000 cubic feet, so that there is no discrimination. After that comes a gradual sliding scale, to-wit: That if a patron consumes 80,000 cubic feet he pays for the first 5,000 cubic feet $10.00; for 20,000 cubic feet $25.00; for 40,000 cubic feet $33.00; for 60,000 cubic feet $39.00; for 80,000 cubic feet $43.00, etc., same as the parties using only such an amount and then the reduction in each case.

Our meter rates to use the expression and opinion of a leading city attorney who has made of the meter rates of his city a careful study and passed his opinion against their rate, after examining our rates carefully, pronounced them "*very fair and equitable*" and "*on strictly business lines the correct one.*" The adoption of our rates by other cities is also a great satisfaction.

The following table shows the number of meters in use for each year since October 1, 1884, and the amount of water pumped, coal consumed, the population and the per *capita*, based on all water pumped.

Year.	Population.	No. of takers.	No. of meters.	Gallons water per year.	Gallons water per day.	Pounds coal per year.	Pounds coal per day.	Gallons per capita.
1884-85.	11,325	699	3	199,333,840	546,120	1,210,150	3,315	48
1885-86.	12,063	876	5	236,649,850	648,355	1,339,900	3,671	53
1886-87.	12,063	980	5	261,308,160	715,885	1,124,200	3,123	59
1887-88.	12,063	1,099	210	257,682,300	704,050	1,047,200	2,861	58
1888-89.	12,063	1,229	385	195,450,770	535,480	914,500	2,540	44
1889-90.	12,063	1,355	441	190,810,910	520,030	1,331,500	3,648	43
	Census 1890.							
1890-91.	13,246	1,405	498	197,889,450	542,162	1,044,000	2,860	38
1891-92.	13,246	1,554	547	236,035,800	646,753	1,173,100	3,214	47
1892-93.	13,246	1,701	673	268,246,300	734,921	1,302,200	3,567	50
1893-94.	13,246	1,820	795	272,006,950	745,224	1,393,800	3,819	48
	Census 1895.							
1894-95.	15,950	1,994	1,223	313,705,500	859,467	1,514,400	4,152	53
	School census.							
1895-96.	17,884	2,186	1,726	325,408,500	891,530	1,558,000	4,268	50
1896-97.	17,884	2,334	2,071	290,972,750	797,186	1,470,600	4,029	45

Notwithstanding the fact that we furnish an enormous amount of free water our per capita has been reduced the past year to 45 gallons per day. The meter system has given general satisfaction both to the consumer and the department. It is the incentive for the best pipes, fixtures (and of the water saving type) of workmanship and a great assistant where there is no plumbing inspection, protects and saves *our excellent water*, of which there is none better, and aids us in being ever ready for the extinguishing of fires.

Our city is divided into two meter districts, the dividing line being Monona and Wisconsin avenues. The reading is taken every month and if an unusual usage of water indicating a leak is discovered, the inspectors notify the parties, to save the taker a large meter bill. Invariably when patrons have a large water bill they will put the fault on the meter (forgetting that the meter was the detective that registered the large amount of water), instead of looking after the leak. By keeping a monthly record we can easily show and prove what month the leak occurred. It will always behoove the patron to look after the leak at once, cut off the water if it possibly can be done, have same repaired, instead of putting the fault on the meter.

Number, size and kind of meters in use October 1st, 1897.

Kind.	Size in Inches.				
	5/8	3/4	1	2	3
Crown	1,445	68	15	2	....
Hersey	229	128	4	2	....
Tomson	115	....	....	....	....
Westinghouse	28	....	....	....	....
Union	26	....	....	....	....
Nash	1	2	....	....	....
Trident	3	....	....	....	....
Worthington	....	2	....	....	1
	1,847	200	19	4	1

Total 2,071

FREE WATER.

As stated under head of meters it is surprising the amount of water that is pumped from which the city receives no compensation. The actual measurement of water that passed through the 2,071 meters was 89,555,415 gallons; if we calculate the same average number of gallons per annum for the remaining 263 takers still without meters, that will add 11,372,909 gallons, a total of 100,928,324 gallons. The amount of water pumped for fires the past year was only 299,250 gallons, which leaves 189,745,076 gallons of free water and accounted for as follows:

After placing a four inch meter to register the amount of water consumed by the water motor in the Sixth ward school we found it to be an average of 80,000 gallons a day, 200 days 16,000,000 gallons, at 5 cents a 100 cubic feet, amounts to $1,069.57. It is wrong to ask the Water Department to furnish this water free. Each department of the city ought to stand on its own basis. Next is the street sprinkling. More streets were sprinkled and more water used than the previous year and less rent collected, only five carts being used by the sprinklers instead of six the year before, which meant $125 less.

After the syphon of the East Washington avenue sewer was discontinued and during the vacation of the schools we made a test as to the demand the street sprinklers made on us. We found that during that time we supplied them with an average of 425,000 gallons per day. If we calculate at an average of 400,000 gallons and 150 days it means 60,000,000 gallons at 5 cents a 100 cubic feet $4,010.70 instead of which the city received only $500.00, a gross injustice to the water takers and the department. The proper and only way, water ought to be sold, for street sprinkling is through a meter attached to cart under lock and key, this would prevent the flooding of streets, and the city would get its fair compensation for the water.

With the adoption of the new sewer system, including flush tanks, Bassett and Rutledge street districts re-

quired thirty-five five-eight taps. Twenty-one of these were not turned on, on account of the enormous drain on the system. The remaining fourteen were gradually reduced, cut off, and finally discontinued and are only turned on at divers times, under the supervision of the city engineer for a general flush and then shut off again.

It will surprise you if we state if only ten of these thirty-five connections would be allowed under a constant flow reduced to a one-fourth opening, the flow of water through the same at an average pressure of eighty pounds would mean one hundred and thirty gallons per minute, 18,720 gallons per day or 68,328,000 gallons in 365 days at 5 cents a 100 cubic feet, $4,567.38.

Then there is the flushing of the sewers and culverts from the hydrants, of which we are unable to make any calculations as to the amount of water used.

Heretofore we have made an estimated consumption of water in the public buildings and schools of six million gallons per annum, this includes the water motors in the churches for pumping the organs, the normal use of water by all, but at times we have discovered that the water in some places was allowed to run all night, which makes our calculation naturally altogether too low. Six million gallons for the fountains per annum will cover same.

We had a bad break in the four-inch main on Baldwin street, the sewermen thoughtlessly using the water main after they had undermined it, for a prop for the street car track. The first car broke it in two. Then there is the different leaks during the year, the flushing of the water mains, the replenishing of the water in the mains, drawn off, to make branch connections when laying new mains, to connect with that district.

WATER PERMITS.

During the year we issued 148 original water permits, making the total takers September 30th in 1897, 2,334.

WATER RENTS.

The annual revenue from the 2,334 takers was $21,471.64, from permits $256, a total of $21,726.64, $1,783.85 less than the previous year; 3,231,612 gallons more of water passed through the meters than in 1895–6 and 34,435,750 gallons less water was pumped during the same time, which would mean at 5 cents 100 cubic feet, $2,301.85. The average for each taker was $9.20.

OPERATING EXPENSES.

The operating expenses for the year ending September 30, 1897, were only $8,781.13 against $11,493.56 in 1895–6, but will show more in next year's expenses, unless the coal will be delivered as this year. Last year the coal was delivered all at once and paid for before the year ended, whereas this year, there being a shortage of anthracite pea coal in the market, only to the amount of $1,218.59 was delivered and paid for, leaving a balance of $1,949.41 still to be paid in the coming year, which would bring the operating expenses to $10,730.54. With the meters we expect to lessen our fuel bill annually.

The receipts from water rents and permits were $21,726.64, carrying a balance of $12,945.51, or under last mentioned, would have been $10,996.10.

We purchased the anthracite pea coal, contracted with James E. Conklin, he being the lowest bidder at $3.99 per ton.

CONSTRUCTION EXPENSES.

The construction, meters, extensions, and improvements for the year ending 1896–7 amounted to $13,358.29, $2,988.81 less than last year, and a balance on hand September 30th of $2,127.96.

REPAIRS.

The repairs during the year amounted to $842.81, and were mostly repairing hydrants caused by street sprinklers, services destroyed by electrolysis, minor leaks, and of the pumps.

WATER.

The continuous service of the engines and pumps during fifteen years of 24 bours daily, gradually brings on repairs, and ofttimes we are unable to make other than slight repairs without interfering with the supply of water, being obliged to even postpone such work until Sundays, when least inconvenience is felt by the takers. Until such time we are liable to draw air, as was the case in the fall of the year, of a sand hole being discovered in the pumps, probably caused by the continuous wear. It was at a time when we could repair only temporarily, and the air was carried into the mains and gave the water a milky appearance. With a direct pressure system this cannot be avoided, and is not detrimental to the water. The water is merely charged with air, which readily rises in bubbles and disappears. If we were pumping into a reservoir, stand pipe, or settling basin, the air would never be noticed.

The coloring of the water at times is caused by the flushing of the mains, disturbing the water of the feed, between the main and the hydrant, and when we are laying new mains in making branch connections, being obliged to draw the water from the surrounding mains in that district, and again filling the same. Our water being mineral, and very sensitive, allowing no shutting off of the circulation for any length of time, the magnesia and iron seemingly settling at the valve where cut off, discoloring the water, and when valve is turned on again, part of the discoloration will mix with the water in spite of our utmost care to draw it off through the hydrants.

Another feature of our water noticeable is the settlings in a vessel or tank after remaining a certain time in a comatose condition, whereas with our reserve basin from which we pump and replenish every day, we have at no time found any settlings whasotever when we have drawn the water out entirely.

We have taken the utmost care of giving the purest water that can be found, without trace of organic matter,

which the analysis proves. Our suction mains are carried through a well drum two feet in diameter and extended to the proper height to the surface of the ground, into the well tubing, all joints of the well drum are tightly caulked with lead. The well drum acts as an air chamber, giving an elasticity to the suction of the pumps, and at the same time serves to prevent surface water from getting into the wells.

SERVICE CONNECTIONS.

During the past year we laid 3,542 feet of services, which brings the number of feet service pipe laid to curbstone to 63,085 feet or $11\frac{5225}{5280}$ miles of pipe.

We also laid 1,086 feet of services to curbstone before streets were macadamized, to prevent tearing up of streets when called for. These are not included in the summing up. There are now 280 taps and service pipes to curbstone on macadamized streets to be connected with when application for water is made, without tearing up the street. The cost of the service connections, including lead pipe and soldering, was $23\frac{1}{4}$ cents a foot.

The following tables show on what streets services were laid the past year for new takers and those ready for connection, giving size, number of feet on each street, and the total:

Table showing services laid for new takers.

Streets and avenues.	⅝ inch.	¾ inch.	1 inch.	Total.
Baldwin	48	....	....	48
Bassett	145	....	....	145
Blair	106	....	....	106
Brearly	58	....	....	58
Broom	48	....	....	48
Canal	29	....	....	29
Clymer	19	....	....	19
Dayton	230	....	....	230
Dickinson	29	....	....	29
Few	29	....	....	29
Francis	48	....	....	48
Gilman	57	....	....	57
Gorham	260	....	....	260
Hancock	48	....	....	48
Henry	49	135	....	184
Jenifer	96	....	....	96
Johnson	247	....	....	247
King	29	....	....	29
Lake	96	....	....	96
Livingston	58	....	30	88
Main	105	....	....	105
Marion	211	....	....	211
Mifflin	48	....	11	59
Mills	96	....	....	96
Mendota Court	9	....	....	9
Murray	19	....	....	19
Patterson	29	....	....	29
Park	29	....	....	29
Rutledge	29	....	....	29
Sherman Avenue	57	....	....	57
Spaight	29	....	....	29
State	96	....	....	96
University Avenue	87	....	....	87
Warren	29	....	....	29
Washington Avenue	462	....	....	462
Williamson	221	....	....	221
Wilson	29	....	....	29
Wisconsin Avenue	48	....	....	48
Total	3,366	135	41	3,542

A four inch cast iron pipe service of nineteen feet to curb, was laid on Park street, to connect with tank and fire service in Ladies' Hall of the University of Wisconsin.

Table showing services laid to curbstone before macadamizing of streets to prevent tearing up for connection hereafter.

Streets or Avenues.	Size.	Number of taps.	Number of feet.
Canal	$\frac{5}{8}$	33	817
Clymer	$\frac{5}{8}$	10	250
Sherman avenue	$\frac{5}{8}$	1	19
Total	....	44	1,086

MEASUREMENT OF SERVICE CONNECTIONS.

As stated in last report, we commenced and have nearly completed bringing the shut-off boxes and also the valve boxes to the surface, and also commenced the record. As we only do this work during leisure hours it will take several years before this work is complete.

NEW MAINS.

During the past year we laid 3,165 feet of six inch and for cross streets 4,860 feet of four inch cast iron pipe, over one and a half miles, placed eight hydrants and seventeen valves.

The following table shows the extensions made during the year, giving size, where laid, number of feet, where hydrants and valves were placed:

Street or Avenue.	Cast iron pipe, 6 inch.	Cast iron pipe, 4 inch.	Hydrants.	Valves.
Brearly street........................	165	....	....	1-6 in.
W. Dayton Street..................	....	1,010	1-4 in.	2-4 "
S. Few street..........................	....	330	....	1-4 "
E. Gorham street....................	....	....	....	1-6 "
Jenifer street........................	....	1,260	1-4 "	2-4 "
W. Johnson street...................	....	....	....	1-6 "
Marion street........................	....	440	1-4 "	1-4 "
Mills street............................	....	....	....	1-4 "
W. Mifflin street....................	....	700	1-4 "	1-4 "
Rogers street.........................	....	420	....	1-4 "
Sherman avenue to Baldwin, on Baldwin to lot line....................	2,280	40	3-4 "	1-6 " 1-4 "
Spaight street.......................	....	660	....	1-4 "
Williamson street..................	720	....	1-6 "	1-6 "
University avenue.................	....	....	....	1-4 "
Total..........................	3,165	4,860	8	17

The laying of these 8,025 feet, including hydrants, valves, valve boxes, complete in every respect, cost $4,807.28, or a trifle less than 60 cents a foot, $1,273.72 less than we estimated; having taken advantage of the low market prices, less obstacles on Sherman avenue than we expected, and the advantage we took of the low marshy soil of the dry season of the year.

We laid this pipe notwithstanding all obstacles we had to contend against, in forty days, at an average of 200 feet a day, employing on an average eighteen diggers and twelve fillers.

The total mileage of water mains September 30, 1897, was $32\frac{60}{5280}$ miles, 158 hydrants, 209 valves, 5,735 feet suction mains, with which are connected 17 valves aside from the above valves; 1,564 feet of lead mains instead of 1,864 last year, having replaced 300 feet of lead with four inch cast iron pipe on Jenifer street.

Applications for mains on Baldwin, Charter and Lorch streets are already filed for the coming season.

PUMPAGE RECORD.

To carry on the work at the pumping station with care and watchfulness by the help we adopted a daily half hour record which each engineer on his watch must record and is filed.

Below we give a facsimile of the record of August 29 and 30, 1897.

Daily record steam and water pressure.

Hour.	Aug. 29, 1896.	Steam pressure.	Water pressure.	Hour.	Aug. 29, 1896.	Steam pressure.	Water pressure.
A. M.				P. M.			
8.30	....	71	82	8.30	....	68	86
9.00	....	70	82	9.00	....	70	88
9.30	....	68	82	9.30	....	70	86
10.00	....	70	82	10.00	....	68	88
10.30	....	66	82	10.30	....	67	88
11.00	....	68	83	11.00	....	69	86
11.30	....	66	88	11.30	....	70	90
12 M.	....	70	84	12.00	....	72	94
P. M.				A. M.			
12.30	....	72	82	12.30	Aug. 30, 1896.	70	82
1.00	....	70	82	1.00	....	68	80
1.30	....	68	81	1.30	....	68	80
2.00	....	72	80	2.00	....	70	82
2.30	....	68	79	2.30	....	70	82
3.00	....	70	79	3.00	....	72	85
3.30	....	68	78	3.30	....	72	85
4.00	....	70	78	4.00	....	70	82
4.30	....	69	79	4.30	....	70	82
5.00	....	67	79	5.00	....	72	82
5.30	....	68	81	5.30	....	75	80
6.00	....	68	81	6.00	....	72	80
6.30	....	70	86	6.30	....	70	80
7.00	....	68	86	7.00	....	75	80
7.30	....	70	90	7.30	....	72	85
8.00	....	70	94	8.00	....	68	80

PUMPAGE RECORD.

Monthly record of the amount water pumped and coal consumed during the year.

(Prepared by Chief Engineer Peter Gauer.)

Months.	Gallons of water pumped.	Revolution of large engine.	Revolution of small engine.	Average steam pressure.	Average water pressure.	Average vacuum.	Pounds of coal consumed.	Net combustible.	Ashes.	Duties in foot lbs. per 100 lbs. net combustibles.
October, 1896......	22,878,000	711,500	578,000	75	90	18	109,800	92,272	17,568	46,661,306
November, 1896....	20,567,750	142,000	1,395,500	75	90	17	105,300	88,452	16,848	42,725,375
December, 1896....	24,092,500	990,000	185,000	75	90	19	120,500	101,220	19,280	44,859,192
January, 1897......	25,458,000	564,500	1,044,000	75	90	17	140,700	118,188	22,512	40,438,750
February, 1897.....	21,173 000	734,000	402,000	75	90	19	130,200	109,368	20,832	37,003,951
March, 1897.........	23,837,500	....	1,907,000	75	90	18	111,900	93,996	17,904	47,357,856
April, 1897.........	22,531,250	....	1,802,500	75	90	20	116,100	97,334	18,756	43,634,046
May 1897	29,006,250	....	2,320,500	75	90	21	144,600	121,464	23,136	43,827,117
June, 1897.........	28,265,500	324,500	1,691,000	75	90	20	133,200	111,888	21,312	47,816,450
July, 1897..........	27,845,000	860,500	714,000	75	90	18	139,000	116,760	22,240	44,555,616
August, 1897.......	22,487,500	....	1,799,000	75	90	18	109,700	92,148	17,552	45,583,104
September, 1897....	22,830,500	231,500	1,419,000	75	90	18	109,600	92,064	17,536	46,330,368
Total........	290,972,750	4,558,500	15,257,500	75	90	18 7-12	1,470,600	1,235,114	235,486	44,232,760

RETROSPECT.

Glancing back after the completion of the fifteenth year of the existence of our water works, it is with a special satisfaction to see the stupendous work that has been accomplished during these years. Hampered as such institutions generally are, and of municipalities especially, obstacles continuously showing themselves, traps laid to ensnare the officers and employees by evil minded persons, endeavors made to engender mistrust by would-be philanthropists, claims made by wiseacres that partiality is shown to water takers, and last of all endeavoring to drag the department into politics. Still with a fair minded public, and of such citizens we have a legion co-operating with its public servants, the work has proceeded right along and the great results achieved.

We have one of the foremost plants of the country, of a world-wide reputation. A plant that cost only $314,251.79 with over 32 miles of mains, including an expenditure of $32,744.24 for service connections to the curb; and $38,008.85 for water meters, both of which were furnished free to the water takers, amounting to a total of $70,753.09. No charge made for laying the water mains to the individual owners of property fronting same, and $37,241.82 for ten artesian wells, including 5,753 feet of suction pipe (a lake connection would not have cost over $5,000).

Our gross receipts from water rents were $212,571.53, operating expenses were $138,460.17, surplus $74,111.36.

Our repairs were only $6,329.51, showing good work done and good material purchased. From water permits we received $4,788.00. We are supplying, calculating by the city directory, about 13,000 of our inhabitants with water an average daily pumpage of only 797,186 gallons, less than 45 gallons per capita, and our yearly consumption of fuel was only 735 tons and 600 pounds of coal.

MANAGEMENT.

Deeply impressed with the careful and efficient management by your honorable body in the magnitude of the achievement, admiring your courage in the furthering and progession of the work carried on, realizing the intricate and difficult problems that have been met and successfully solved; with an unflagging zeal in the performance of your arduous duties and responsibilities, willing to give your time and abilities *free* to the city, guarding the funds entrusted sacredly, accomplishing such grand results, you ought and will meet the highest commendation and aid of our citizens in this great work.

CONCLUSION.

In closing this report, I take the occasion to express my grateful appreciation to each member of the board for the kind forbearance, assistance and valuable counsel rendered in the discharge of my duties. With your kind aid in the past, it shall be my endeavor to labor for the continuous success and increased results of the "Madison City Water Works." I also desire to express my utmost satisfaction and gratitude to the secretary, meter inspectors, chief engineer and assistants, firemen and laborers for the ever ready, prompt and faithful discharge of their respective duties, thereby aiding to carry on the work successfully to obtain the prosperous results achieved.

Respectfully submitted,

JOHN B. HEIM,
Superintendent.

SUMMARY OF STATISTICS.

REPORT OF 1896 AND 1897.

CITY WATER WORKS, MADISON, DANE COUNTY, WISCONSIN.

Population by census, 1895	15,950
Population estimated by directory	17,884
Date of construction	1881–1882
By whom owned	City of Madison
Source of supply	10 artesian wells
Mode of supply	The water is drawn direct from the artesian wells and up to a distance of 5,010 feet from station
1. Pumping machinery	Reynolds–Corliss engines with Knowles pumps combined
2. Description of coal	Anthracite pea
3. Price per ton	$3.99
4. Coal consumed for the year in lbs.	1,470,600
5. Coal consumed for the year in tons	$735\frac{600}{2000}$
6. Total pumpage for the year in gallons	290,972,750
7. Average static head against which pumps work	$207\frac{90}{100}$
8. Average dynamic head against which pumps work	$226\frac{40}{100}$
9. Duty in foot pounds per 100 pounds of coal net cumbustible, making no deduction for starting, banking fires, heating of building, or anything else	44,232,760
10. Cost of pumping, figured on operating expenses, including cutting of lawn, shoveling of snow and care of grounds	* $\$30\frac{17}{100}$.

* If all the coal had been delivered, $\$36\frac{87}{100}$.

11. Per million gallons raised one foot high (dynamic)	$13\frac{35}{100}$ cents
12. Net cost of plant to date	$314,251.79

CONSUMPTION.

1. Estimated population	17,884
2. Estimated population supplied	13,000
3. Total number of gallons pumped	290,972,750
4. Average daily consumption in gallons	797,186
5. Number of takers	2,334
6. Number of meters	2,071
7. Average gallons pumped per day for each taker	393
8. Average gallons pumped per capita per day	45
9. Average pounds of coal consumed per day	4,029
10. Average pounds of coal consumed per day each taker	630

DISTRIBUTION.

1. Kind of pipe used for mains	Cast iron
2. Size	From 4 to 16 inches
3. Total miles of mains	$32\frac{60}{5280}$
4. Total hydrants	158
5. Total valves	209
6. Kind of pipe used for services	Extra strong lead
7. Total miles of service pipe (lead)	$11\frac{5225}{5280}$
8. Total feet of cast iron suction pipe	6,279

ANALYSIS OF WATER.

	City water.	Waukesha Bethesda springs.
Potassium sulphate	0.237	0.454
Sodium sulphate	0.286	0.542
Sodium phosphate	Trace.	Trace.
Bi-carbonate of soda	1.094	1.256
Bi-carbonate of lime	15.224	17.022
Bi-carbonate of magnesia	12.984	12.388
Bi-carbonate of iron	0.214	0.042
Sesgui-oxide of aluminum	Trace.	0.122
Silica	0.414	0.741
Sodium chloride	0.292	1.100
Organic matter	None.	1.983
Total solid contents per gallon	30.755	35.715

INVOICE OF PIPE AND SPECIALS.

72 feet of 16-inch cast iron pipe.
6 feet of 14-inch cast iron pipe.
170 feet of 12-inch cast iron pipe.
66 feet of 10-inch cast iron pipe.
18 feet of 8-inch cast iron pipe.
112 feet of 6-inch cast iron pipe.
40 feet of 4-inch cast iron pipe.
84 feet of 3-inch cast iron pipe.
One 16x16x4x4 cross.
One 16x16x8 tee.
One 16-inch cap.
One 12x12x12 tee.
One 8x8x8 tee.
One 4x4x3 tee.
One 4x4x2 tee.
One 8 to 6 reducer.
One 8 to 4 reducer.
Two 6-inch plugs.
One 4-inch 45° elbow.
One 4-inch 90° elbow.
One 16-inch sleeve.
Two 14-inch sleeves.
Three 12-inch sleeves.
Three 10-inch sleeves.
Five 8-inch sleeves.
Three 6-inch sleeves.
Six 4-inch sleeves.
Two 3-inch sleeves.
Two 2-inch sleeves.
Two 5-inch hydrants.
Four 4-inch hydrants.
Six 5-inch hydrant rods with valve attached.
Twelve 4-inch hydrant with rods with valve attached.
One sprinkling crane.
One nye pump.
One trench pump.

RECORD OF FIRES DURING THE YEAR.

Date.	Time.	Duration.	Pressure at station.	Gallons of water pumped.	No. of box.	Extinguished by chemical or no water used.
Oct. 12, 1896.	7:05 p. m.	25 m	100–105	4,000	34	....
Oct. 19, 1896.	11:53 p. m.	....	....	....	12	No water.
Oct. 21, 1896.	7:40 p. m.	....	....	....	21	No water.
Oct. 23, 1896.	8:05 p. m.	35 m.	95–105	12,000	3	....
Nov. 1, 1896.	5:15 p. m.	10 m.	85–90	1,500	61	....
Nov. 9, 1896.	6:00 p. m.	1.05 m.	85–95	8,000	43	....
Nov. 9, 1896.	8:04 p. m.	....	....	....	31	No water.
Nov. 13, 1896.	1:55 p. m.	....	....	....	41	No water.
Nov. 17, 1896.	11:15 p. m.	....	....	....	31	No water.
Nov. 24, 1896.	6:50 a. m.	35 m.	95–110	8,000	62	....
Nov. 28, 1896.	5:05 p. m.	....	....	....	46	No water.
Dec. 19, 1896.	4:45 p. m.	....	....	....	64	No water.
Dec. 21, 1896.	5:45 a. m.	20 m.	90–100	6,000	14	....
Jan. 4, 1897.	5:50 p. m.	....	....	....	28	No water.
Jan. 19, 1897.	3:35 p. m.	....	....	....	26	No water.
Feb. 4, 1897.	7:25 p. m.	....	....	....	41	No water.
Feb. 7, 1897.	6:30 p. m.	....	....	....	16	No water.
Feb. 13, 1897.	10:20 p. m.	....	....	....	16	No water.
Feb. 14, 1897.	3:30 a. m.	....	....	....	None.	Fal'e al'm
Feb. 17, 1897.	6:55 p. m.	....	....	....	32	No water.
Feb. 22, 1897.	1:30 a. m.	2.05 m.	95–105	82,500	45	....
Feb. 27, 1897.	11:10 a. m.	....	....	....	46	No water.
Feb. 28, 1897.	10:25 a. m.	....	....	....	16	No water.
Mar. 4, 1897.	12:50 a. m.	....	....	....	51	No water.
Mar. 16, 1897.	5:30 p. m.	....	....	....	46	No water.
Mar. 22, 1897.	7:50 p. m.	....	....	....	45	No water.
Apr. 7, 1897.	4:45 a. m.	10 m.	90–100	3,000	51	....
Apr. 23, 1897.	8:55 p. m.	....	....	....	23	No water.
May 10, 1897.	7:35 p. m.	1.15 m.	75–80	56,250	14	....
May 10, 1897.	9:05 p. m.	50 m.	80–100	28,000	13	....
May 19, 1897.	6:30 a. m.	....	....	....	41	No water.
May 21, 1897.	4:35 p. m.	40 m.	90–100	21,000	45	....
May 24, 1897.	1:30 a. m.	30 m.	85–100	12,000	45	....
May 30, 1897.	6:05 p. m.	55 m.	85–100	21,000	......	....
June 14, 1897.	4:00 p. m.	....	....	....	64	No water.
July 4, 1897.	2:30 a. m.	....	....	....	61	No water.
July 26, 1897.	1:15 p. m.	....	....	....	53	No water.
Aug. 12, 1897.	3:06 a. m.	1.00 m.	85–90	10,000	51	....
Aug. 25, 1897.	2:55 p. m.	35 m.	82–85	12,000	16	....
Aug. 31, 1897.	8:35 p. m.	....	....	....	51	No water.
Aug. 31, 1897.	9:05 p. m.	25 m.	85–90	2,000	51	....
Sept. 7, 1897.	7:15 p. m.	45 m.	79–81	12,000	52	....
Sept. 9, 1897.	1:35 p. m.	....	....	....	21	No water.
Sept. 9, 1897.	4:25 p. m.	....	....	....	26	No water.
				299,250		

FIRE ALARMS.

Signals of the fire alarm from bells and whistle are as follows, and is same number of blows as number of box:

SIGNAL BOXES.

Box.	*Location.*	*Box.*	*Location.*
3.	Fuller & Johnson W'ks, 3 blows.	41.	Main, Carroll and Hamilton St.
12.	Wisconsin Av. and Gorham St.	43.	Wilson and Broom St.
14.	State, Gilman and Broom St.	45.	West Main St., at C., M. & St. P. tracks.
16.	Mifflin and Broom St.	46.	Washington Av. and Brooks St.
18.	State and Fairchild St.	51.	University Av. and Lake St.
21.	Washington Av. and Canal St.	52.	State and Park St.
23.	Dickinson and Dayton St.	53.	West Johnson and Park St.
24.	Johnson and Few St.	54.	University Av. and Mary St.
26.	Johnson and Patterson St.	61.	Main and Blount St.
27.	Gorham and Butler St.	62.	Jenifer and Brearley St.
28.	Pinckney, Mifflin and Hamilton St.	63.	Williamson and Livingston St.
31.	Pinckney and Doty St.	64.	Jenifer and Baldwin St.
32.	Main and Hancock St.	65.	Winnebago St. and Atwood Av., near Elmside.
34.	Wilson and Blair St.		

INSTRUCTIONS FOR OPERATING FIRE ALARM BOXES.

Key can be had at any one of the nearest houses to the boxes. Unlock the door, pull the hook all the way down and let go. Do not jerk the hook down and up, but pull it down steadily as far as you can. Wait at the box until the department arrives and inform them where the fire is.

The tower bell will strike and the whistle will blow --- ---- three blows, a short pause, then four blows; after which a longer pause. The above will be repeated three additional times. The whistle will give the alarm twice.

Each key is registered. Do not attempt to remove the key; it will be released and returned when the fire is out.

Signals for use of department only are as follows:

Fire out — one tap.

More pressure — two taps.

Second alarm — two taps repeated.

RULES FOR THE WATER METERS.

The following rules have been adopted by the Board of Water Commissioners, to govern the use of water meters:

SECTION 1. All services which may hereafter be connected with the City Water Works system shall be connected with the meter furnished by the city, if such services shall include sewerage, cesspool or sprinkling of street, or lawns. And all other services and connection shall be so placed that meters can be attached whenever the Board of Water Commissioners may direct it to be done. The water rent wherefore such meter shall have been placed shall be according to the measurement of the meter used. All water meters shall be placed inside of buildings. From and after Jan. 1, 1896, water meters will be placed on all premises that now have the service connection where the present rate of water rent equals or exceeds five dollars ($5) per annum, and in connection with all services used for sprinkling purposes and where yard hydrants are used, and also in connection with such other services where it shall be discovered that there is a constant flow of water, or no meter being used, or as the Board of Water Commissioners may from time to time deem proper and necessary. All new water services hereafter made for domestic purposes only shall be so constructed and placed that meters can be readily attached whenever the Board of Water Commissioners may order the same to be done.

SECTION 2. The City of Madison will furnish one meter for one building free to consumers. All meters must be placed by a licensed plumber at expense of property owners, and as near as possible to where service pipe enters building. The plumber doing the work must flush pipe thoroughly before connecting the meter. The city will repair all meters that are clogged, and if lead chips are found to be the cause, a fine of $1.00 will be collected from the plumber doing the work for each and every job so found before issuing another permit to said plumber. No water meter shall be removed or disturbed without first having obtained permission from the Superintendent of the Water Works.

SECTION 3. A check and waste shall be placed between the shut-off cock and the meter, within one foot of the meter. All meters shall be so located and placed as to afford easy access thereto, and so that they can be easily examined and read. In all cases where meters have been ordered and have been supplied, no water from the City Water Works shall be

taken, received or supplied to the building for which the same was constructed and intended except that which shall pass through and be registered by such meter.

SECTION 4. The consumers of the water supplied through any water meter shall make all necessary repairs for the proper operation of such water meter, and in case the City of Madison shall deem it necessary and expedient to repair a defective water meter, the expenses of such repair shall be chargeable to such consumers, and shall be paid at the time such repair was made, and in case of failure to pay for such repair, the Superintendent of the Water Works shall shut off the flow of water furnished through such meter.

SECTION 5. In case any water meter should fail to register the quantity of water passing through the same, the consumer will be charged at the rate of the average daily consumption registered by such meter before the same became out of repair.

SECTION 6. In all cases where one service connection or yard hydrant does supply two or more separate consumers, premises, tenements, business houses or a block occupied by divers parties, one meter only will be placed at the service connection of either or all of said consumers, and the water rent as registered by said meter shall be chargeable to and payable by the owner of said premises or buildings.

SECTION 7. The rate of water rent to be charged where such meters are in use shall be according to the schedule rate established by ordinances, the minimum whereof being in all cases two dollars and twenty-five cents ($2.25) per six months for each taker.

SECTION 8. Water rents, where meters have been placed, shall be collected for first six months at the schedule rate, thereafter as per record of meter the preceding six months in a manner as prescribed in section 13 of water works ordinance, for each building, premises or consumer. No water meter rental will be charged by the City of Madison.

SECTION 9. The Superintendent of the water works system, or any person employed by the Board of Water Commissioners, shall be given free and ready access to the premises and buildings for the purpose of examining or repairing any meter or connection therewith. Any and all meters shall be left in the condition and manner as set by the city, and shall not be interfered with in any manner whatsoever.

SECTION 10. In case of any violation of any of the foregoing rules and regulations, the water supply furnished to the consumer guilty of such violation shall be immediately shut off, and shall not be resumed except upon a satisfactory adjustment of all the differences connected therewith, and upon the payment of the sum of one dollar for shutting off and turning on the water. Anybody violating any of these rules and regulations shall, upon conviction thereof, be subjected to a fine not to exceed twenty-five dollars ($25) and the cost of prosecution.

METER RATES.

First 5,000 cubic feet or less, per six months, per hundred cubic feet, 20 cents.

Over 5,000 cubic feet and up to 20,000 cubic feet, per six months, add $10.00 for first 5,000 cubic feet and 10 cents for each additional 100 cubic feet.

Over 20,000 cubic feet and up to 30,000 cubic feet, per six months, add $25.00 for first 20,000 cubic feet and 5 cents for each additional 100 cubic feet.

Over 30,000 cubic feet and up to 60,000 cubic feet, per six months, add $30.00 for first 30,000 cubic feet and 3 cents for each additioual 100 cubic feet.

Over 60,000 cubic feet and up to 90,000 cubic feet, per six months, add $39.00 for first 60,000 cubic feet and 2 cents for each additional 100 cubic feet.

Over 90,000 cubic feet, per six months, per 100 cubic feet 5 cents.

Minimum per six months, $2.25.

CITY OF MADISON

DEPARTMENT OF WATERWORKS

JOHN B. HEIM, Superintendent

COMMISSIONERS

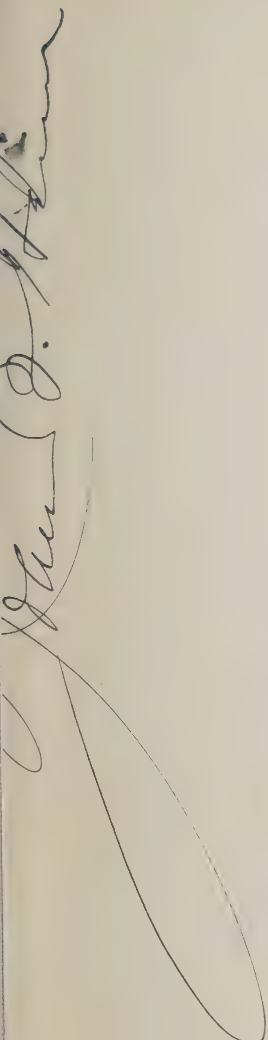
JOHN R. MELVIN, PRESIDENT
J. J. SILBERNAGEL
J. VAN ETTA
C. E. WHELAN, MAYOR, EX-OFFICIO
EDW. QUAMMEN, ALDERMAN, EX-OFFICIO
O. S. NORSMAN, SECRETARY

Madison, Wis. July 22 1898

H. O. Nourse Bureau of Water.
Chicago Ill.

Dear Sir:-
We forward you our last annual report, which we think covers all your inquiries under another head

Yours Respy




MAP OF THE
WATER WORKS SYSTEM
OF
MADISON
WISCONSIN.
EXPLANATION
UNIVERSITY GROUNDS
LAKE MENDOTA
LAKE MONONA
LAKE WINGRA
BROOKS ADDITION
BOWEN'S ADDITION
UNIVERSITY ADDITION
WRIGHT'S ADD.
WARRENS ADDITION
SOUTH MADISON
ORTON PARK
1st Wd.
2nd Wd.
3rd Wd.
4th Wd.
5th Wd.
6th Wd.
7th Wd.
8th Wd.
CHICAGO AND NORTH-WESTERN
CHICAGO MILWAUKEE & ST. PAUL
CHICAGO MADISON & NORTHERN
WASHINGTON AVE
MAIN
WILSON
JOHNSON
GORHAM
GILMAN
MIFFLIN
WILLIAMSON
JENIFER
SPAIGHT
LIVINGSTON
PATTERSON
SCALE
10 Chains to an Inch

Sixteenth Annual Report

...OF THE...

City Water Works

...OF...

Madison, Wisconsin,

1898.

Compliments of

John B. Heim

Superintendent.

WATER WORKS PUMPING STATION.

SIXTEENTH ANNUAL REPORT

OF THE

Board of Water Commissioners

OF THE

CITY OF MADISON,

FOR THE YEAR ENDING SEPTEMBER 30, 1898,

TOGETHER WITH

REPORTS OF THE SUPERINTENDENT AND SECRETARY.

MADISON, WIS:
STATE JOURNAL CO., CITY PRINTERS,
1899.

LIST OF WATER COMMISSIONERS[1]

Under whose charge the Water Works was placed, and time served.

COMMISSIONERS.

James Conklin	1884–5–6–7–8–9
H. Christoffers	1884–5–6–7–8–9–90–1–2–3–4
R. M. Bashford[2]	1884–5–6
John Lamont[3]	1886–7–8–9–90–1–2–3
A. Donovan	1889–90–1–2
John R. Melvin	1892–3–4–5–6–7–8
W. W. Warner	1893–4–5–6
J. J. Silbernagel	1894–5–6–7–8
J. Van Etta	1896–7–8

EX-OFFICIO.

H. N. Moulton,[4] Mayor	1885–6
A. Donovan, Alderman	1885–6
E. W. Keyes, Mayor	1886–7
M. J. Cantwell, Alderman	1886–7
James Conklin, Mayor	1887–8
G. J. Corscot, Alderman	1887–8
M. R. Doyon, Mayor	1888–9
S. G. Oakey, Alderman	1888–9
M. R. Doyon, Mayor	1889–90
E. L. Baker,[5] Alderman	1889–90
F. C. Sheasby,[6] Alderman	1889–90
R. M. Bashford, Mayor	1890–1
H. Schulkamp, Alderman	1890–1
W. H. Rogers, Mayor	1891–2–3
H. Schulkamp, Alderman	1891–2–3
John Corscot, Mayor	1893–4
R. F. Taylor, Alderman	1893–4
John Corscot, Mayor	1894–5
W. C. Noe, Alderman	1894–5
Jabe Alford, Mayor	1895–6
W. H. Lansing, Alderman	1895–6
A. A. Dye, Mayor	1896–7
Edward Quammen, Ald'man	1896–7
M. J. Hoven, Mayor	1897–8
Edward Quammen, Ald'man	1897–8
Chas. E. Whelan, Mayor	1898–9
Edward Quammen, Ald'man	1898–9

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[1] First Commissioners elected April 15, 1884.

[2] Resigned March 1, 1886.

[3] Elected to fill vacancy.

[4] Mayor and Alderman ex-officio added to Board April, 1885.

[5] Resigned.

[6] Elected to fill vacancy.

OFFICERS OF THE WATER WORKS.

JOHN R. MELVIN, President . . .	Term expires October 1, 1901.
J. J. SILBERNAGEL	Term expires October 1, 1900.
J. VAN ETTA	Term expires October 1, 1899.
CHAS. E. WHELAN	Mayor, *ex officio.*
EDWARD QUAMMEN	Alderman, *ex officio.*

O. S. NORSMAN, Secretary.

SUPERINTENDENT,
JOHN B. HEIM.

METER INSPECTORS,
NICHOLAS REIF.
FRANK T. HAYES.

ENGINEERS,
PETER GAUER,
DENNIS DACEY,
AUSTIN GANNON.

FIREMEN,
PATRICK DORIS,
JOHN LYONS.

WATER WORKS OFFICE,

CITY HALL, SECOND FLOOR.

Regular meetings of the board Wednesday previous to common council meeting of each month at 3 o'clock p. m.

All bills against the Department must be rendered on or before the 28th of each month, or they will lie over until the following regular meeting.

Water rents are due and payable, in advance, at the office of the City Treasurer, on the first days of January and July of each year.

CITY ORDINANCE.

"*All water rents shall be paid semi-annually, the first days of January and July of each year, in advance; any water rents, whether by schedule or meter,* which shall not be paid within thirty days after the same become due and payable, shall be increased by a penalty of ten per cent., and if the same shall not be paid, together with the penalty thereto attached, within ten days after the same become due and payable, the water shall be shut off from the consumer so in default."

REPORT OF THE COMMISSIONERS.

Office of the
Board of Water Commissioners,
City of Madison, Wis., March 1, 1899.

To the Honorable Mayor and Common Council of the City of Madison:

We have the honor to submit herewith our sixteenth annual report, covering the operations of the Water Works department of this city for the year ending September 30, 1898.

The Superintendent's report gives detailed information on all matters connected with the management of the Water Works plant, and we only desire to call your special attention to the more important recommendations made by him. The question of providing new pumping machinery at the station is one that is liable to become a serious one at almost any moment, and the financial affairs of the department must of necessity be managed with this end in view. The Superintendent's recommendation that a special valve attachment be made to a certain number of the fire hydrants, for the use of the street-sprinkling contractors, meets our hearty approval, and we hope to equip at least some of these hydrants with this device during the coming sprinkling season.

Your attention is respectfully invited to the very favorable showing made by the department in the matter of furnishing its own light at the pumping station, the results of this experiment being very gratifying indeed.

Finally we desire to express our approval of the other recommendations and suggestions made by the Superintendent,

feeling assured that all have for their object the increased efficiency and success of the works.

Respectfully submitted,

John R. Melvin, President,
J. J. Silbernagel,
J. Van Etta,
Chas. E. Whelan,
Ed. Quammen,
Board of Water Commissioners.

SECRETARY'S STATEMENT.

Receipts and expenditures of the Water Department for the year ending September 30, 1898.

RECEIPTS.

Water rents	$23,115 17	
Water permits	326 00	
State of Wisconsin — service capitol park	40 30	
Meter repairs	37 05	
Lead pipe sold	11 85	
Old material sold	11 82	
Tax of 1897	5,000 00	
Balance Oct. 1, 1897	6,021 20	
	$34,563 39	

EXPENDITURES.

Construction and extensions		$8,966 69
Operating expenses		11,004 44
New boilers and engineering		3,675 00
General repairs		1,021 11
Meter returned		10 00
Water rent refunded		2 50
Transferred to sinking fund		5,000 00
Balance Oct. 1, 1898		4,883 65
	$34,563 39	$34,563 39

MISCELLANEOUS.

Total receipts for water rents from construction of works to Oct. 1, 1898	$235,686 70
Total receipts from water permits, same period	5,114 00
Total operating expenses to Oct. 1, 1898	149,464 61
Total cost of construction and extensions to Oct. 1, 1898	323,218 57
Total cost of repairs to Oct. 1, 1898	7,350 70
Cost of new boilers	3,675 00
Amount of bonds issued for construction of plant	76,000 00
Amount of this issue outstanding	8,000 00
Water Works extension bonds issued in 1893	10,000 00
Total amount of water bonds outstanding	18,000 00

Respectfully submitted,

O. S. NORSMAN,

Secretary.

SUPERINTENDENT'S REPORT.*

MADISON, WIS., FEB. 28, 1899.

To the Honorable the Board of Water Commissioners:

GENTLEMEN:— In obedience to the provision of the Ordinance of the Water Department, I have the honor to submit herewith the Sixteenth Annual Report of the Water Department of the city of Madison for the year ending September 30, 1898. The report shows the improvements and extensions made, the splendid results achieved during the past year, including suggestions and recommendations.

FINANCIAL.

The financial condition of the past year is fully up to any of the preceding years. Your honorable body decided on a venture to conduct the plant on its own earnings, thereby aiding the city in its general fund. This has more than met your anticipations. The statement of the Secretary shows that we had a balance to our credit October 1, 1898, of $4,883.65, and every bill was paid. Our aim is to pay each month all indebtedness that has accrued against the department, whether due or not.

Our construction, extensions, additions, etc., did not suffer; we added two new boilers; laid additional mains and service connections; lowered mains and services after grading was done and before macadamizing; placed new valves; raised and placed new service boxes and attended to the general repairs.

Our original indebtedness of $76,000, heretofore reduced to

* Appended to this report is the paper prepared and read by the Superintendent on "Water Meter and Rates" at the convention of the American Water Works Association held at Buffalo, N. Y., June 14–18, 1898.

BOILER ROOM

$8,000, will remain until the year 1902, when the limit of the bonds expire. The city prefers to wait until that time, and in the meantime pay off other bonds. The original indebtedness will then be wiped out, and the only indebtedness that will remain will be the $10,000 extension bonds of 1893.

PUMPING MACHINERY.

The time is drawing near when your honorable body will be obliged to make arrangements for new pumps.

The engines are in splendid condition, but the pumps are causing us all manner of trouble and are constantly under repair. They should not be allowed to be used much longer — certainly not more than two years. We do not know when they may break down, as they are now continually out of order. Arrangements ought to be made at once looking to the purchase of new pumps in the near future.

The buildings of the pumping station could be enlarged this year, and be made ready for a Triple Expansion Condensing Pumping outfit next year.

This is a serious matter and should receive your prompt attention. Aside from the required need, the economy derived will more than compensate the interest on the investment.

NEW BOILERS.

The new boilers are a decided success. The contractor was unable to turn them over at the specified time, and they were not complete until the end of March. A full description, with a capacity and economy test of the boilers, was given in my last report.

We have had only a six months' trial, but the results show that they have fully come up to the guarantee. During the year we consumed 594½ pounds of coal for each taker against 630 the previous year. The contract price was $3,500, and that was all that was paid. There were no extras.

The accompanying plate shows that the boilers are a credit

to the plant, and that we now have one of the most pleasant boiler rooms to be found.

ELECTRIC LIGHT.

The installation of our electric light plant previous to the commencement of our fiscal year enables us to give results obtained.

Heretofore we used only five gas burners, three in the engine-room and two in the boiler room, which cost us for the years 1892–96, $1,217.27, or an average of 243.45\frac{2}{3}$ per year. The entire cost of the electric light plant, with a capacity of fifty incandescent lamps, was $587.10. Interest on same at five per cent. would amount to $29.36 per annum. The cost of operating for the fiscal year from October 1, 1897, to September 30, 1898, was for lamps, $19.25; brushes, eighty cents; cylinder oil, $7.62; crank case oil, $6.40; machine oil, $3, and waste, fifty cents; making a total of $37.57 (this includes the illumination during the semi-centennial); adding the interest, makes the total cost $66.93 for the year. For five years it would amount to $334.65, a gain over gas for same period of $882.62.

The extra consumption of coal is not noticeable. The running of a 125 H. P. boiler to do 50 H. P. work during the night is a benefit to us rather than a loss in fuel. That there was no additional cost in fuel to run the plant is shown by the fact that we consumed 1,470,600 pounds of coal in 1897 against 1,470,200 pounds in 1898. There were 400 pounds less of coal consumed and there was an increase of 139 takers.

We burn 30 lamps on an average, lighting the engine and boiler room, coal vault, basement and main entrance, — in fact it is as pleasant at night as in the day-time, — at a cost of eighteen cents per day, against sixty-six and two-thirds cents per day for a dimly-lighted station. Formerly we had only five gas jets, and the engineers were compelled to move around the engines with torch in hand looking for the oil openings.

The total indebtedness on the plant, deducting the cost of operation, interest on the investment, and not considering the benefits derived by the illumination, will be fully wiped out in three and one-third years.

IMPROVEMENTS.

During the year we placed a valve at the intersection of Johnson and Few streets, to shorten the district. We thus save much inconvenience to water takers when we are compelled to shut down for repairs in that district. We also continued, when time permitted, raising and replacing curb-boxes for measurement record.

STREET SPRINKLING.

The use of the fire hydrants by the street sprinklers is a continued nuisance and expense, and endangers the hydrants for fire protection. The street sprinkler will break a hydrant, thus disabling it for fire purposes, for which it is intended. He fails to notify the department, and should a fire occur, the department would be blamed. Again, by the continuous use of the hydrants during the summer and until late in the fall, the soil around the waste of the hydrant becomes thoroughly soaked. It has no time to dry before the frost sets in and thus endangers the hydrant, should it be used during cold weather, by preventing it from wasting at the bottom and allowing the water to freeze on top of valve.

Something must be done. We dare not open a hydrant in winter for flushing that is used by the street sprinklers. We cannot put up stand pipes, as they would be a continuous nuisance. Additional hydrants are too expensive and liable to be used for fire purposes. The only remedy will be additional valves with hose couplings attached to the hydrants. These will have to be removed every fall and replaced every spring. The greatest trouble is that the most particular and essential part of a water-works plant is a fire hydrant, and it is handled

the most carelessly, where the plant is owned by the city. It is a temptation, if there is something wrong with the sewer or culvert, to make the hydrant do the work. I would advise that fifty valves be purchased, and that the street sprinklers be prohibited from using any hydrant except one that has a valve attached. This should be the case, also, if possible, for flushing sewers and culverts.

LOWERING OF MAINS AND SERVICES.

During the past year we lowered the mains and services on Bassett and Johnson streets, which were to be macadamized, after grading of streets had been done and before receiving the stone. This is always an unpleasant task, as we have to fairly crowd ourselves on to the street. The contractor doing the work objects to our interference, and he invariably endeavors to get his material on the street before our force can commence work. Some provision ought to be made compelling the contractor to wait a reasonable time for us to lower the mains and services, and the surveyor to give the grade to the department, so that we can prepare for it. Thus far we have had to be on the alert and feel our way.

METERS.

During the past year we increased our meters from 2,071 to 2,269, an increase of 198, being 139 new and 59 old takers, leaving still 188 takers without meters. With the gradual completion of the sewer system, and the connection of these takers with the same, all our patrons will soon be under the meter system.

The total amount expended up to September 30, 1898, for meters of all sizes, and including the meter boxes and the placing of the meters by the department in 1888–9, was $40,165.43, an average of $17.75 per meter.

The total amount of water pumped the past year was

273,016,500 gallons, against 290,972,750 gallons the previous year, or 17,956,000 gallons less. This means 91 gallons less per day for each taker, and a per capita of 41½ as against 45 gallons the previous year.

The total amount of water that passed through the meters the past year was 97,520,813 gallons, for which the city received $20,342.65, against 89,555,415 gallons and $17,168.28 last year.

If we allow an annual average use of water for the takers without meters, with no sewer connections, at same ratio as metered water, it would mean 7,414,532 gallons, for which the city received only $2,772.52.

Only 92,500 gallons of water were pumped for fire purposes during the past year, leaving 167,988,655 gallons of free water accounted for as follows: Street sprinkling, 60,000,000 gallons: water motor Sixth ward school, 16,000,000 gallons; churches, schools, public buildings, fountains, etc., 18,000,000 gallons; sewer flush tanks, 34,164,000 gallons; a total of 112,164,000 gallons, leaving 55,824,655 gallons for flushing, leaks and waste when laying new water mains. If the city had received pay for every gallon pumped, *which is an utter impossibility*, we would have collected at the rate of 6½ cents per hundred cubic feet to secure the same receipts collected, whereas the average meter rate collected was 15⅔ cents per hundred cubic feet, and the amount under the schedule rate was only $2\frac{4}{5}$ cents per hundred cubic feet for unmetered water, or a loss of over 11 cents per 100 cubic feet.

Our minimum rate per annum is $4.50, or $2.25 per six months. You will be surprised to learn that 806 takers paid only the minimum rate last January, and 1,061 takers paid the same last July. Four hundred and seventy-five takers consumed less than 500 cubic feet the first, and 261 takers the last six months, which means $1 and less. Sixteen takers consumed less than 100 cubic feet the first six months and five

takers less than 100 cubic feet the last six months, amounting to less than twenty cents during the six months. Nine hundred and twenty-seven takers in January and 843 takers in July paid the twenty-cent rate.

The average cost of operation for each taker the past year, exclusive of the interest on the investment, was $4.45. Still, some of the patrons who consume less than the minimum object to paying the mininum rate. They want to pay for only what they use.

If the city collected only as to the usage, without a minimum, how many would stint themselves still more in the usage of water and economize to a still greater extent at the expense of the other takers?

In connection with every article, benefit or luxury that we purchase there is a minimum. Why should water be an exception? If we take a ride on the street railway the minimum is five cents, whether we ride a block or a mile. If we include our family there is an additional charge. If we engage a horse or carriage at a livery the minimum is a fixed price. If we do not get to our destination in the time allowed we have to pay for the additional time consumed. If we purchase a ticket to travel by rail we have to pay a fixed price to our destination; no refunding for stopping at a way station or junction before our station is reached. If we rent a pew in church and fail to occupy the same by non-attendance at the services, it does not excuse us from paying the amount agreed.

So it is with every article that we purchase, whether by weight or measure. If we purchase a beverage or stimulant by the glass, we pay a minimum price whether we drink it all or not. We pay the same price per day or week for board whether we eat a full meal or miss a meal. The cost of the article and preparation must be paid by the consumer.

If we purchase at wholesale we pay a less rate than by retail. So it is with the water. If we purchase and agree to take water from the city under its ordinances and rules and a

minimum price is fixed, we must pay the same whether we use that quantity or not. The city does not restrict us in the use, only in the waste. The service must be paid. It costs as much to look after a small consumer as after a large one.

Our meter rates are fixed according to the commercial usage the world over, and it is the only true way. Those cities which have adopted a flat rate, and have no fixed minimum (there are only a few), much to their regret, have been obliged to call on the general fund to make up the deficiency. The money must come from some source. Somebody must pay the fiddler.

The following table shows the number of meters in use for each year since October 1, 1884, the amount of water pumped, coal consumed, the population and the per capita, based on all water pumped.

Year.	Population.	No. of takers.	No. of meters.	Gallons water per year.	Gallons water per day.	Pounds coal per year.	Pounds coal per day.	Gallons per capita.
1884-85.	11,325	699	3	199,333,840	546,120	1,210,150	3,315	48
1885-86.	12,063	876	5	236,649,850	648,355	1,339,900	3,671	53
1886-87.	12,063	980	5	261,308,160	715,885	1,124,200	3,123	59
1887-88.	12,063	1,099	210	257,682,300	704,050	1,047,200	2,861	58
1888-89.	12,063	1,229	385	195,450,770	535,480	914,500	2,540	44
1889-90.	12,063	1,355	441	190,810,910	520,030	1,331,500	3,648	43
	Census 1890.							
1890-91.	13,246	1,405	498	197,889,450	542,162	1,044,000	2,860	38
1891-92.	13,246	1,554	547	236,035,800	646,753	1,173,100	3,214	47
1892-93.	13,246	1,701	673	268,246,300	734,921	1,302,200	3,567	50
1893-94.	13,246	1,820	795	272,006,950	745,224	1,393,800	3,819	48
	Census 1895.							
1894-95.	15,950	1,994	1,223	313,705,500	859,467	1,514,400	4,152	53
	School census.							
1895-96.	17,884	2,186	1,726	325,408,500	891,530	1,558,000	4,268	50
1896-97.	17,884	2,334	2,071	290,972,750	797,186	1,470,600	4,029	45
1897-98.	17,884	2,473	2,269	273,016,500	750,730	1,470,200	4,028	41½

The following table shows the number, size and kind of meters in use October 1, 1898:

Kind.	Size in Inches.				
	⅝	¾	1	2	3
Crown	1,643	68	15	2	....
Hersey	229	128	4	2	....
Thomson	115	....	....	....	....
Westinghouse	28	....	....	....	....
Union	26	....	....	....	....
Nash	1	2	....	....	....
Trident	3	....	....	....	....
Worthington	....	2	....	....	1
	2,045	200	19	4	1

Total 2,269

METER REPAIRS.

It has been thought by many that it requires quite a sum to repair meters. I will state that all the expense we incur is for a laborer. The meter inspectors, when they discover a meter out of order on their rounds, report it at the office. At the end of the reading, during the month, one of the meter inspectors attends to this matter. The chief engineer attends to the repairing, and the laborer to the washing out of the magnesia, sand and grit that may have accumulated in the meter. The engineer repairs and re-tests them, and then they are replaced. The time of the laborer thus far has been twenty-four days, on an average, per year, which amounts to $36, and the necessary specials $15, making a total of $51, which would mean 1260 tenths of one per cent. on the investment. If all the labor of the engineer and inspector had been paid for it would mean $181, or 450 tenths of one per cent., or less than one-half per cent. on the investment. The past year we repaired 275 meters, or twelve per cent. of the full number in use, and the cost to repair would be eighteen and one-half cents per meter.

So you can see that the cost of meter repairs is but a trifle. If a meter is broken by the frost the city furnishes the special part destroyed, at cost, to the consumer, and repairs the same free of charge.

SCHEDULE RATE.

Time and again the question has been raised by some takers with regard to the city collecting at the schedule rate for the first six months or more, where a meter has been placed. The Water Works ordinance provides that the water rent must be collected in advance and at the schedule rate, and the meter rules provide, in conformity with the ordinance, that the meter must be placed six months before the meter rate is considered and collected as the registration of the meter shows during this period. The schedule rate is collected as a deposit, and a receipt given in advance as water has been used. This rule was adopted with the general meter system and there can be no refunding; otherwise all takers who have had a meter placed since 1888 would be entitled to the same privilege for all payments made previous to that time. A time and limit must be fixed in all cases. Again, at what rate would we collect? It certainly could not be at a uniform or flat rate. The least a patron can pay for a six-room house or less is at the rate of $5 per annum. Shall an eight, ten or twelve-room house, or over, with bathroom, laundry, etc., pay only at the same rate, or a trifle more? How shall we collect from a hotel, laundry, manufactory? Does it not require a fixed rate to treat all, as far as possible, impartially? The practical results during all these years of the course pursued by your honorable body, and the adoption by other cities of our method and rates, prove that it must be the true principle.

WATER PERMITS.

During the year we issued 139 original water permits, making the total takers September 30, 1898, 2,473. There should be over 2,500 takers, as the receipts of the water permits show.

At present there are forty services shut off, some of which are liable to be turned on at any time.

Quite a few of these connections were only for street sprinkling by hose (now dispensed with), and property owners are waiting for the sewer system to pass their premises to connect. Others have been consolidated under one service for a block, and some discontinued entirely.

WATER RENTS.

The annual revenue from the 2,473 water consumers was $23,115.17; from permits, $326; a total of $23,441.17,—being $1,643.54 more from water rents than received during the previous year. More water by 7,865,398 gallons passed through the meters than in 1896-7, and 17,956,250 gallons less water was pumped during the year. The average for each taker was $9.48½, against $9.20 the previous year.

OPERATING EXPENSES.

The operating expenses for the year ending September 30, 1898, were $11,004.44. Of this amount, $1,758.88 belongs to the previous year, being for coal paid for during the past year for 1896-7. It really places our operating expenses at $9,245.56. We called your attention to this matter in our last year's report. There will always be a variation in this item on account of the delivery of the coal, but we can get at the average per year. The past three years the average was $10,426.37 per year.

Last year's balance from water rents over operating expenses was $12,110.73, and for the three years the average per year was $12,187.72.

We purchased the anthracite pea coal from James E. Conklin, he being the lowest bidder, at $3.84 per ton.

CONSTRUCTION EXPENSES.

The expense of construction, meters, extensions, new boilers

and improvements for the year ending 1897–8 amounts to $12,641.69; this is $717.60 less than the previous year.

REPAIRS.

The repairs during the year amounted to $1,021.11; this is $178.30 more than the previous year.

SERVICE CONNECTIONS.

During the past year we laid 3,621 feet of lead services, which brings the number of feet of extra strong lead service pipe laid to curbstone to 66,706 feet, or $12\frac{3566}{5280}$ miles of pipe. We also laid 1,235 feet of lead services to the curbstone before the streets were macadamized, to prevent tearing up of streets, when called for. These are not included in the summing up. There are now 334 taps and service pipes to the curbstone on macadamized streets to be connected with, when application for water is made, without tearing up the street.

The following tables show on what streets service pipes were laid the past year for new takers and those ready for connection, giving size, number of feet on each street, and the total:

Table showing services laid for new takers.

Streets and Avenues.	⅝ inch.	¾ inch.	1 inch.	Total.
Bassett	19	....	....	19
Blount	113	....	....	113
Brooks	58	....	....	58
Butler	19	....	....	19
Canal	29	....	....	29
Carroll	48	13	....	61
Charter	96	....	....	96
Dayton	289	....	....	289
Dickinson	29	....	....	29
Few	29	....	....	29
Francis	213	....	....	213
Gilman	58	....	....	58
Hancock	48	....	....	48
Hamilton	112	....	....	112
Henry	29	....	....	29
Jane	19	....	....	19
Jenifer	48	....	....	48
Johnson	260	....	....	260
Langdon	19	....	....	19
Livingston	109	....	....	109
Lorch	39	....	....	39
Main	77	....	....	77
Marion	29	....	....	29
Mifflin	203	....	....	203
Mills	86	160	....	246
Mound	139	....	200	339
Murray	29	....	....	29
Rogers	57	....	....	57
Sherman	48	....	....	48
Spaight	48	....	....	48
State	37	....	....	37
University Avenue	278	....	....	278
Warren	19	....	....	19
Washington Avenue	269	....	....	269
Webster	29	....	....	29
Williamson	279	....	....	279
Wilson	38	....	....	38
Total	3,248	173	200	3,621

Table showing services laid to curbstone before macadamizing of streets, to prevent tearing up for connection hereafter.

Street and Avenue.	Size.	Number of taps.	Number of feet.
Bassett	⅝	3	96
Blair	⅝	11	289
Johnson	⅝	40	850
Total	....	54	1,235

MEASUREMENT OF SERVICE CONNECTIONS.

We were not able, on account of a very busy season, to complete the bringing of the curb boxes to the surface and the measurement of the same. The valve boxes are nearly complete. We hope to be able to complete the work during the present year.

NEW MAINS.

During the past year we laid 3,895 feet of four-inch cast-iron pipe, and placed three hydrants and eight four-inch valves in connection with these mains.

The following table shows the extensions made during the year, giving size laid, number of feet, and where hydrants and valves were placed:

Street or Avenue.	Cast-iron pipe, 4-inch.	Hydrants.	Valves.
Bassett street	412	... .	1 4-in.
Breun street	484	1 4-in.	1 4-in.
Charter street	474	1 4-in.	1 4-in.
W. Dayton street	990	....	1 4-in.
E. Johnson street, to divide district	....	....	1 6-in.
Lorch street	670	1 4-in.	....
Spring street	454	....	....
State street	246	....	1 4-in.
University avenue	165	....	1 4-in.
E. Washington avenue, for tower	....	....	1 10-in.
Total	3,895	3	8

The laying of these 3,895 feet, including hydrants, valves, and valve boxes, complete in every respect, cost $2,104.18, or a trifle less than 54 cents a foot. This pipe was laid in sixteen days, at an average of 245 feet a day. No valve was placed on the main connecting the tower when it was built. The valve in the tower being unfit for use most of the time, and the tower more or less out of order all the time, we placed a ten-inch valve on the main feed on the Avenue off from Pinckney street to control the same. A six-inch valve was also placed on Johnson street off from Few street to shorten the district in case of repairs. The total mileage of water mains September 30, 1898, was $32\frac{3955}{5280}$ miles, 161 hydrants, 217 valves, 5,735 feet of suction mains from wells (with which are connected 17 valves aside from the valves in the water mains), and 1,564 feet of lead mains.

Provision ought to be made to lay a four-inch main on Baldwin street to connect Sherman avenue with Gorham street, to do away with the dead end on Sherman avenue. The same course ought to be pursued on Bedford street to connect Mifflin street with West Washington avenue. But first of all, the Board should insist upon this that some steps be taken by the city to allow the department to run across lots to connect the water main on Francis street with the Lake street main through Mendota Court and remove the lead service in the court. These two points are a continuous trouble and expense.

The pumpage records follows here:

PUMPAGE RECORD.

Monthly record of the amount of water pumped and coal consumed during the year.

(Prepared by Chief Engineer Peter Gauer.)

Months.	Gallons of water pumped.	Revolution of large engine.	Revolution of small engine.	Average steam pressure.	Average water pressure.	Average vacuum.	Pounds of coal consumed.	Net combustible.	Ashes.	Duty in foot lbs. per 100 lbs. net combustibles.
October, 1897......	23,393,250	533,500	932,500	88	93	18	100,200	84,168	16,032	47,032,650
November, 1897....	20,431,250	903,000	50,500	88	93	17	121,300	101,892	19,408	34,207,811
December, 1897....	20,059,750	315,500	1,049,500	88	97	17	127,900	107,436	20,464	32,746,956
January, 1898......	20,988,000	954,000	....	88	98	17	138,400	114,056	24,344	32,737,800
February, 1898.....	20,304,750	475,500	787,500	88	95	17	122,100	102,570	19,530	34,312,573
March, 1898........	21,402,000	728,500	430,000	88	96	18	132,200	111,048	21,152	34,877,670
April, 1898.........	20,911,000	950,500	136,000	88	93	17	128,100	107,204	20,896	32,367,040
May, 1898..........	24,483,750	... .	1,959,500	88	93	19	127,700	107,268	20,432	38,491,629
June, 1898.........	26,231,250	....	2,098,500	88	93	20	124,700	104,848	19,852	42,508,962
July, 1898..........	27,500,000	....	2,200,000	88	93	20	127,000	106,680	20,320	43,823,713
August, 1898.......	23,337,500	....	1,867,000	88	93	18	108,700	91,408	17,392	44,147,875
September, 1898....	23,974,000	459,500	1,106,000	88	93	18	111,900	93,996	17,904	43,107,733
Total..........	273,016,500	5,320,000	12,617,000	88	94	18.2	1,470,200	1,232,574	237,706	38,360,201

RECORD OF FIRES DURING THE YEAR.

Date.	Time.	Duration.	Pres'ure at Station.	Gallons of water pumped.	No. of Box.	Extinguished by chemical or no water used.
1897.						
Oct. 6....	1:30 a m	.30	85–90	6,000	45	....
10....	6:30 p m	.10	85–95	6,500	28	....
21....	11:30 a m	.40	86–95	9,000	43	....
Nov. 20....	9:20 p m	....	....	....	45	No water.
22....	8:15 p m	....	....	....	26	No water.
27....	8:17 p m	....	....	....	34	No water.
Dec. 1....	7:00 p m	....	....	....	14	No water.
5....	1:50 a m	1.00	90–100	12,000	26	....
11....	7:35 p m	.25	90–100	2,000	31	....
1898.						
Jan. 3....	3:50 p m	....	....	....	34	No water.
27....	7:35 p m	....	....	....	45	No water.
Feb. 2....	1:15 p m	....	....	....	31	No water.
2....	1:10 a m	....	....	....	18	No water.
18....	7:35 a m	....	....	....	64	No water.
22....	7:05 p m	....	....	....	16	No water.
27....	12:15 p m	....	....	....	16	No water.
March 12....	5:30 p m	....	....	....	62	No water.
12....	6:45 p m	....	....	....	14	No water.
13....	3:45 a m	....	....	....	14	No water.
14....	7:30 p m	....	....	....	14	No water.
21....	8:40 a m	....	....	....	21	No water.
April 4....	8:30 p m	....	....	....	3	No water.
17....	9:00 p m	.30	100–120	3,000	24	....
19....	11:45 a m	....	....	....	18	No water.
27....	9:50 p m	.40	90–105	12,000	31	....
30....	3:35 p m	.35	85–100	10,000	21	....
May 20....	4:10 a m	1.20	90–100	18,000	34	....
June 8....	11:56 p m	.55	90–100	14,000	64	....
20....	1:40 a m	....	....	....	14	No water.
July 13....	1:30 a m	....	....	....	14	No water.
30....	4:10 p m	....	....	....	34	No water.
Aug. 7....	10:05 a m	....	....	....	64	No water.
11....	2:30 a m	....	....	....	14	No water.
Sept. 4....	12:45 a m	....	....	....	12	No water.
21....	1:50 a m	....	....	....	14	No water.
25....	3:30 p m	....	....	....	34	No water.

RETROSPECT.

We are now past the sixteenth year of the existence of our Water Works. It is always a pride and great satisfaction to see what great work has been accomplished during these years and to see the plant of which every taxpayer of Madison is a stockholder. Our good work accomplished through municipal ownership has attracted wide attention, and has been and is held up as a model for other cities to follow.

The results achieved prove that the plant has been and is conducted in and for the interest of the city of Madison and its citizens.

The plant at the end of the fiscal year has cost $326,893.48 The gross receipts from water rents were $235,686.76; operaing expenses, $149,464.61, giving net receipts of $86,222.09. Cash received for water permits, $5,114.00, making a total of $91,336.90. Repairs have cost $7,350.62. We have paid interest since construction in the sum of $10,993.56. If we calculate a depreciation on the plant of 5 per cent. (which really cannot be taken into account, the plant to-day being worth two or three times its cost), it would amount to $16,345.00, a total of $34,689.18, making a total net receipt of $56,646.91, or 17⅓ per cent.

There are very few Water Works plant that can make a better showing.

MANAGEMENT.

Your honorable body can well feel proud of such results, feeling that with your untiring devotion, without compensation, the reward is assured. Your work is appreciated by a fair-minded public, and you will receive the aid of our citizens in still furthering this great work.

CONCLUSION.

Let me, before closing this report, express my gratitude to each member of the board for the ready assistance, wise coun-

sel, and confidence reposed. It shall be my endeavor, with your kind aid, to labor for the continued success and increased results of the Madison City Water Works. I desire also to express my satisfaction to the secretary, meter inspectors, chief engineer and assistants, firemen and laborers for the ever-willing, prompt and faithful discharge of their respective duties, striving with us for continued success and prosperous results.

Respectfully submitted,

JOHN B. HEIM,

Superintendent.

SUMMARY OF STATISTICS.

Population by census	15,950
Population estimated by directory	17,884
Date of construction	1881–1882
By whom owned	City of Madison
Source of supply	10 artesian wells
Mode of supply	The water is drawn direct from the artesian wells and up to a distance of 5,010 feet from station
1. Pumping machinery	Reynolds-Corliss engines with Knowles pumps combined
2. Description of coal	Anthracite pea
3. Price per ton	$3.84
4. Coal consumed for the year in lbs.	1,470,200
5. Coal consumed for the year in tons	$735\frac{200}{2000}$
6. Total pumpage for the year in gallons	273,016,500
7. Difference between center of pump and gauge	9 feet
8. Average static head against which pumps work	$227\frac{87}{100}$
9. Average dynamic head against which pumps work	$245\frac{87}{100}$
10. Duty in foot pounds per 100 pounds of coal net combustible, making no deduction for starting, banking fires, heating of buildings, or anything else	38,360,201
11. Cost of pumping, figured on operating expenses, including cutting of lawn, care of grounds and shoveling of snow per million gallons	$40.20

12. Cost per million gallons raised one foot high (dynamic)	$16\frac{68}{100}$
13. Net cost of plant to date	$326,893.48

CONSUMPTION.

1. Estimated population	17,884
2. Estimated population supplied	13,000
3. Total number of gallons pumped	273,016,500
4. Average daily consumption in gallons	750,730
5. Number of takers	2,473
6. Number of meters	2,269
7. Average gallons pumped per day for each taker	302
8. Average gallons pumped per capita per day	$41\frac{1}{2}$
9. Average pounds of coal consumed per day	4,028
10. Average pounds of coal consumed per year for each taker	$594\frac{1}{2}$

DISTRIBUTION.

1. Kind of pipe used for mains	Cast iron
2. Size	From 4 to 16 inches
3. Total miles of mains	$32\frac{3955}{528}$
4. Total hydrants	161
5. Total valves	217
6. Kind of pipe for services	Extra strong lead
7. Total miles of service pipe (lead)	$12\frac{3566}{5280}$
8. Total feet of cast-iron suction pipe	6,279
9. Total valves with suction pipe	17

ANALYSIS OF WATER.

	City water.	Waukesha Bethesda springs.
Potassium sulphate	0.237	0.454
Sodium sulphate	0.286	0.542
Sodium phosphate	Trace.	Trace.
Bi-carbonate of soda	1.094	1.256
Bi-carbonate of lime	15.224	17.022
Bi-carbonate of magnesia	12.984	12.388
Bi-carbonate of iron	0.214	0.042
Sesqui-oxide of aluminum	Trace.	0.122
Silica	0.414	0.741
Sodium chloride	0.292	1.100
Organic matter	None.	1.983
Total solid contents per gallon	30.755	35.715

INVOICE OF PIPE AND SPECIALS.

72 feet of 16-inch cast iron pipe.
6 feet of 14-inch cast iron pipe.
158 feet of 12-inch cast iron pipe.
66 feet of 10-inch cast iron pipe.
12 feet of 8-inch cast iron pipe.
88 feet of 6-inch cast iron pipe.
180 feet of 4-inch cast iron pipe.
72 feet of 3-inch cast iron pipe.
Two 16x16x8 tee.
One 16-inch cap.
One 12x12x12 tee.
One 8x8x8 tee.
One 4x4x4 tee.
One 4x4x3 tee.
One 4x4x2 tee.
One 8 to 6 reducer.
One 8 to 4 reducer.
One 6-inch curve.
Two 6-inch offsets.
Two 6-inch plugs.
Two 4-inch plugs.
One 16-inch sleeve.
Two 14-inch sleeves.
Three 12-inch sleeves.
Three 10-inch sleeves.
Five 8-inch sleeves.
Two 6-inch sleeves.
Two 4-inch sleeves.
Two 3-inch sleeves.
Two 2-inch sleeves.
Two 5-inch hydrants.
Six 4-inch hydrants.
Four 5-inch hydrant rods with valve attached.
Eight 4-inch hydrants rods with valve valve attached.
One sprinkling crane.
One nye pump.
One trench pump.
One differential block.
Fifteen pigs of lead.
Fifteen valve boxes.
Forty-two feet 9-inch well tubing.
Twenty-five meters.
Forty-six meter boxes.

FIRE ALARMS.

Signals of the fire alarm from bells and whistle are as follows, and is same number of blows as number of box:

SIGNAL BOXES.

Box.	*Location.*
3.	Fuller & Johnson W'ks, 3 blows.
12.	Wisconsin Av. and Gorham St.
14.	State, Gilman and Broom St.
16.	Mifflin and Broom St.
18.	State and Fairchild St.
21.	Washington Av. and Canal St.
23.	Dickinson and Dayton St.
24.	Johnson and Few St.
26.	Johnson and Patterson St.
27.	Gorham and Butler St.
28.	Pinckney, Mifflin and Hamilton St.
31.	Pinckney and Doty St.
32.	Main and Hancock St.
34.	Wilson and Blair St.
41.	Main, Carroll and Hamilton St.
42.	Mound and Mills St.
43.	Wilson and Broom St.
45.	West Main St., at C., M. & St. P. tracks.
46.	Drake and Brooks St.
51.	University Av. and Lake St.
52.	State and Park St.
53.	West Johnson and Park St.
54.	University Av. and Mary St.
61.	Main and Blount St.
62.	Jenifer and Brearley St.
63.	Williamson and Livingston St.
64.	Jenifer and Baldwin St.
65.	Winnebago St. and Atwood Av., near Elmside.

INSTRUCTIONS FOR OPERATING FIRE-ALARM BOXES.

Key can be had at any one of the nearest houses to the boxes. Unlock the door, pull the hook all the way down and let go. Do not jerk the hook down and up, but pull it down steadily as far as you can. Wait at the box until the department arrives and inform them where the fire is.

The tower bell will strike and the whistle will blow for No. 34 --- ---- three blows, a short pause, then four blows; after which a long pause. The above will be repeated three additional times. The whistle will give the alarm twice.

Each key is registered. Do not attempt to remove the key; it will be released and returned when the fire is out.

Signals for use of department only are as follows:

Fire out — one tap.

More pressure — two taps.

Second alarm — two taps repeated.

RULES FOR THE WATER METERS.

The following rules have been adopted by the Board of Water Commissioners to govern the use of water meters:

SECTION 1. All services which may hereafter be connected with the City Water Works system, and all services that are still without a water meter, shall be connected with the meter furnished by the city. All meters must be placed by a licensed plumber at expense of property owners, and as near as possible to where service pipe enters building. The plumber doing the work must flush pipe thoroughly before connecting the meter. The city will repair all meters that are clogged, and if lead chips are found to be the cause, a fine of $1 will be collected from the plumber doing the work for each and every job so found, before issuing another permit to said plumber. No water meter shall be removed or disturbed without first having obtained permission from the Superintendent of the Water Works.

SECTION 2. A check and waste shall be placed between the shut-off cock and meter, within one foot of the meter. All meters shall be so located and placed as to afford easy access thereto, and so that they can be easily examined and read. In all cases where meters have been ordered and have been supplied, no water from the City Water Works shall be taken, received or supplied to the building for which the same was constructed and intended except that which shall pass through and be registered by such meter.

SECTION 3. The consumers of the water supplied through any water meter shall make all necessary repairs; when destroyed by frost, the City of Madison will make all such repairs at cost. A licensed plumber must remove and replace such meter. The expenses of such repair shall be chargeable to such consumers, and shall be paid at the time such repair was made and in case of failure to pay for such repair, the Superintendent of the Water Works shall shut off the flow of water furnished through such meter. No defective meter snall be removed without first having obtained permission from the Superintendent of the Water Works.

SECTION 4. In case that any water meter should fail to register the quantity of water passing through the same, the consumers will be charged at the rate of the average daily consumption registered by such meter the corresponding month of the previous year.

SECTION 5. In all cases where one service connection or yard hydrant does supply two or more separate consumers, premises, tenements, business houses or a block occupied by diverse parties, one meter only will be placed

at the service connection of either or all of said consumers, and the water rent as registered by said meter shall be chargeable to and payable by the owner of said premises or buildings. Parties desiring more than one meter must furnish them at their own expense.

SECTION 6. Water rents, where meters have been placed, shall be collected for the first six months and fraction thereof at the schedule rate, as it will require the registration of six months, that is from one rent day to the next, to be able to get the amount to collect. Thereafter as per record of meter the preceding six months, in a manner as prescribed in section 13 of water works ordinance, for each building, premises or consumer. No rebate will be allowed. No water meter rental will be charged by the City of Madison. The rate of water rent to be charged where meters are in use shall be according to the meter rate established by these rules, the minimum whereof being in all cases two dollars and twenty-five cents ($2.25) per six months. Meters will be read monthly.

SECTION 7. The Superintendent of the Water Works system, meter inspectors, or any person employed by the Board of Water Commissioners, shall be given free and ready access to the premises and buildings for the purpose of examining or repairing any meter or connection therewith. Any and all meters shall be left in the condition and manner as set by the city, and shall not be interfered with in any manner whatsoever.

SECTION 8. In case of any violation of any of the foregoing rules and regulations, the water supply furnished to the consumer guilty of such violation shall immediately be shut off, and shall not be resumed except upon a satisfactory adjustment of all the differences connected therewith, and upon the payment of the sum of one dollar for shutting off and turning on the water. Anybody violating any of these rules and regulations shall, upon conviction thereof, be subjected to a fine not to exceed twenty-five dollars ($25), and the cost of prosecution.

METER RATES.

First 5,000 cubic feet or less, per six months, per hundred cubic feet, 20 cents.

Over 5,000 cubic feet and up to 20,000 cubic feet, per six months add $10.00 for first 5,000 cubic feet and 10 cents for each additional 100 cubic feet.

Over 20,000 cubic feet and up to 30,000 cubic feet, per six months, add $25.00 for first 20,00 cubic feet and 5 cents for each additional 100 cubic feet.

Over 30,000 cubic feet and up to 60,000 cubic feet, per six months, add $30.00 for first 30,000 cubic feet and 3 cents for each additional 100 cubic feet.

Over 60,000 cubic feet and up to 90,000 cubic feet, per six months, add $39.00 for first 60,000 cubic feet and 2 cents for each additional 100 cubic feet•

Over 90,000 cubic feet, per six months, per 100 cubic feet, 5 cents.

Minimum per six months, $2.25.

WATER METERS AND RATES.

By John B. Heim, Superintendent City Water Works, Madison, Wis.

METERS.

At our convention in Atlanta, Ga., in 1895, I gave a paper entitled "Our Experience with Water Meters," giving the splendid results our city obtained by adopting the "General Meter System," up to that time. My object was to encourage other plants to do likewise, and enjoy the benefits of the system. I hoped also to assist our co-workers in meeting the objections raised to the meter system by giving the practical results, to act as an entering wedge in aiding and assisting in the perplexity of securing an abundance of water, and at less cost. I trust I succeeded, in many instances, in helping to establish such facts, and that the results have been as good if not better than our own. There are still many of our co-workers handicapped and discouraged by their citizens and patrons. The patrons fear larger water bills and that they will be stinted in the use of water. This is all wrong; at least, it has so proven itself with us. This being the case, I felt it would not be amiss to give the practical results we have obtained in fuller detail, with the renewed hope that I may assist others in the adoption of a "General Meter System." Ten years ago the prejudice against the measuring of the water was so strong that it often cost the official head, if insisted upon. Because of the rapid strides and satisfactory results of the meter system since then, wherever adopted, it ought not to be as difficult to procure its introduction now. A careful and shrewd business manager cuts off all unnecessary waste, and at the end of the year finds his gains. Why should he not do the same with the water? Because it appears that the water drawn from the lakes or rivers seems plentiful, and therefore ought to be free as air, is not good reasoning. People forget that it requires machinery and fuel to pump and furnish same, and that every gallon costs money. There is no need for stinting the plentiful use of water, and the rates can be fixed accordingly. The mission of the meter is not to deprive us of plenty of water, but to prevent its waste. The tendency of all of us is to get as much as we possibly can for little or nothing; we always want the lion's share, if only some one else pays for it. Indirectly, we may probably pay doubly for it.

To my utter astonishment, I noticed in the water works journals of last July, that a citizens' committee of Savannah, Ga., petitioned its water commissioners to abolish the meter system, claiming that the meter system tends to restrict the legitimate use of water, thereby endangering the health of the city, and aside from that, that their meters were so defective as to giqe rise to serious irregularities and injustice. From statements given, the city owned and had placed 200 on one street, controlled and repaired them. After giving this committee a hearing and investigating the charges, the commissioners decided to abandou the meter system and to return to the old plan of assessing the rates. Can it be possible that after *investigating these charges* such should be the outcome? It is stated that the supply is drawn from deep wells and the water is of excellent quality. Nevertheless, they abolish the meter system, knowing that such a supply is limited.

It is a mistaken idea that a meter system restricts a legitimate or a plentiful use of water. There is not a water works in existence that has adopted the meter system that for one moment desires to restrict the use of water for necessary purposes and plenty of it, desirable from a sanitary tandpoint. Their only aim is to restrict the careless waste and leaks. We

find in our city that the water meter is a fairly accurate instrument, and we are anxious for the day when every tap is metered. We teach our takers how to read the meter; we purchase only the straight-reading meter, so that any one in the family can read it, and we ask them to read it when we find an unusual waste. We call their attention to it and assist them in reading it wherever we can, and to-day we have but little complaint of the water bills. If there are complaints they are from patrons who pay no attention to our notice or neglect to repair the leaks. The proper course to pursue to prevent stinting in the use of water is to adopt a minimum rate. Then establish a rate that will give plenty of water for all necessary purposes. The selling of water by meter measurement is the only fair and just principle. The careful person, as well as the extravagant, gets value received. Under the schedule rate, the careful person pays for the extravagance of the other. Under the meter system, if a taker has a large lawn, takes pride in it, sprinkles all day, he pays for it the same as if he desires the best in the market for which he is willing to pay. Under the schedule rate the other takers are obliged to assist him in keeping his lawn fresh and green. Our meter system is now in its tenth year and very popular. Should we decide to go back to the schedule rate there would be such an uprising in opposition that woe be to the man who would father it.

Our schedule rates are: For a six-room house, $5; one water closet, $2.50; one bath tub, $3 — $10.50 per annum. At this rate we collect for the first six months in advance, for a new building or an old service, where a meter has been placed; after that, per record of the meter the preceding six months. We close our records the first of June and December, to be ready for collection by the first of January and July. Here is where we discover the great objection to the schedule rate. We considered our schedule rate, before adopting the meter system, a very low one, but the meter rate brings the water rent considerably less, where there is no waste, and naturally the patrons want the lower rate. Another objection to the meter system is the fear of the financial results. We will give you a few illustrations of our experience and you can judge for yourself.

1. In 1888, when we adopted the "General Meter System" and commenced placing the meters, at the expense of the city, we discovered some very great leaks. The leaks were not repaired for several days, so that we could see what they amounted to; I will only mention three. In one instance the city received under the schedule rate $12 per annum, the waste under meter amounted to $600 per annum; the annual average payment now, under meter, with more fixtures, is $42.48. Another instance: The annual schedule rate was $32, the waste was $912; the annual average meter rate now is $368.33. The third instance: The city received under schedule rate, $60 per annum; the waste amounted to $949. The city now receives on an average of $45.68 per year.

2. To further illustrate, I will give the saving of the water and fuel. We will give the pumpage of the two coldest and the two hottest months of the year previous to the adoption of the meter system, and the ninth year of the meter system, with 263 takers still without meters.

In the month of December, 1886, we had 980 takers; we pumped 25,517,200 gallons of water. December, 1896, with 2,334 takers, we pumped 24,092,500 gallons, a difference of 1,424,700 gallons less than in 1886. In January, 1887, 980 takers, we pumped 23,450,100 gallons. January, 1897, 2,334 takers, we pumped 25,458,000 gallons; 2,008,000 gallons more than in 1887. July, 1887, 980 takers, we pumped 24,239,500 gallons. July, 1897, 2,334 takers, 27,845,500 gallons; 3,606,000 more than in 1887. August, 1887, 980 takers, we pumped 25,917,500 gallons. August, 1897, 2,334 takers, we pumped 22,487,500 gallons; 3,430,000 gallons less than in August, 1887. Only 760,000 gallons more in 1896-7, with 1,354 more consumers and an estimated free water of 131,000,000 gallons, against 35,000,000 gallons in 1886-87. The average pumpage per day in 1887 was 715,885 gallons; in 1897, only 794,446 gallons. In 1887, with a minimum of $6.00 per annum, 980 takers and no meters, we collected $13,479.69. Last year, with a minimum of $4.50 per annum, 2,071 meters and 2,334 takers, we collected $21,471.64.

Our consumption of coal in 1887 was 1,124,200 pounds, or 1,148 pounds for each taker. Last year it was 1,470,600 pounds, or 630 pounds for each taker. We commenced placing our meters on the 21st of May, 1888, and on the 1st of October we had 210 placed. We therefore cannot consider this year in the saving of fuel, but as we checked some very flagrant wastes I have brought it within my calculations on the actual saving.

During these ten years, averaging 207 meters added each year, the actual saving on fuel was $16,893.19, a saving of over 44 per cent. on the investment of meters. Last year the saving on fuel was $2,066.82, our coal being $3.99 per ton against an average of $5.25 per ton heretofore. In 1887 we pumped for each taker 266,642 gallons. In 1897, only 124,667 gallons, or less than half, including over 4 per cent. more free water.

3. Another illustration of the reform that the meter system has brought about is in collecting water rents. One patron under the schedule rate paid the city $22.50 per annum; a meter was placed, and the first monthly reading showed a leak. The patron was notified; he insisted it was the meter and wanted it removed, which, of course, was not done. When he came to pay the water rent he found a bill of $15.94 for six months, and he again insisted it was the meter. We offered to test it, let him supervise it in every shape or manner, and if the meter did not register exactly, he would not have to pay a cent. He accepted our offer, tested, and found our statement correct; but being still unsatisfied, asked for another meter. We gave him another, but this meter showed the same leakage. Then he followed our advice, found the leak and repaired it, and his average water bill since (now nine years) has not been over $15.34 per annum.

In another instance, where the general average was between $3 and $4 per annum, a leak occurred, and no attention was paid to it. The bill amounted to $27.38 and had to be paid, but is now back to its original average. Again, three tenements on one service; three separate meters independent of each other, with same fixtures to each. One paid $4.50, another $9.03, and the other $24.31 per annum, the latter a very careless tenant, indifferent because the landlord paid the water rent. The three are now down to $4.50 per annum each. Another tenement family during three years paid on an average $13.18 per annum. This family moved out and a new family moved in. The water rent advanced to $16.01 in six months, the latter allowing the water closet to run continually. The next bill was only $5.20.

Another house rated under schedule $20.50 per annum. The meter reduced it to $14.37 on an average. A new servant took a notion to let the water run, and increased the bill to $22.81. It is now back to the original.

Another instance, where the average consumption was 1,500 cubic feet per month, a leak brought it to 44.653 cubic feet in one month.

Another: Where a house was rated under schedule, with sprinkling of lawn, at $28.50 per annum, the average under the meter is $38.30.

A boarding house, where the annual meter rent under different tenants did not go beyond $15.91 per annum, a new tenant brought it to $42.20 in three months. We shut these parties off, because they insisted upon letting the water run.

Another instance: A meter was ordered placed in a residence where there was no sewer connection. Meter indicated an underground leak of 578 cubic feet the first month. There was no cellar under the kitchen; only one faucet. We notified the party. Answer: "It is the meter." Next month it had increased to 801 cubic feet; next month to 926; it was still in the meter. Next month it had increased to 1,309 cubic feet, and finally heed was paid. Upon examination a leak was discovered in the check, the waste being worn out. A new check and waste were put in, and the following month brought the registration down to 245 cubic feet and an admission of the correctness of the meter.

Will give but another instance—that where a party took the record of the meter every evening before going to bed, for a period of six months, testing and measuring, unknown to the department. He filed his observa-

tions with us, stating that any one that doubted the correctness of the water meters to show them his records and send them to him; he would give his experience. He will swear by the meter. Another party who had no faith in the meters made the same observations, with the same results. He voluntarily came to us to state his conversion, and gave us authority to use his name. Like one of old, he was made strong in the faith by the use of water. I could enumerate a great many more instances, and also of those that save from 10 to 40 per cent. and more of the schedule rate without stinting themselves in the use of water; but let these suffice to show what a meter system does.

One other objection to the meter system is the free-water craze. The cry is, Water should be free as air. Such it is when vouchsafed to us by a kind Providence in the form of rain or snow, but it also required the energy of the elements through the laws of nature. If we have a well at our doorside, it costs money to build and repair the same. When we desire to enjoy a boat ride and we are in the midst of a river or lake rowing the boat, and we want a drink, it costs us twenty cents or more an hour, unless we carry the nut brown beverage with us, which is still more expensive. When we lay water mains, with wells or the water supply from mains near at hand, it costs 50 cents a day for a water boy. Where is the water free as air? The operation and mode of supply must be paid for by those who get the benefit, and the rates must be fixed accordingly. Let us compare our city, with a population of 17,884, supplying 73 per cent. of our inhabitants, with another city not a great distance from us, with a population (census 1895) of 28,769, supplying only 50 per cent. of its inhabitants, where they have no meter system and the water seemingly is as free as air. They have 2,908 takers, 574 more than we have, and four miles more of mains. Their annual pumpage was 1,627,852,100 gallons during the year; we pumped 290,972,750 gallons, only a slight difference of 1,336,879,350 gallons more than we pumped; their daily average was 4,459,870 gallons, against our 794,446 gallons; their per capita is 155 to our 45 gallons per day. They consumed 3,857 cords of pine slabs, at a cost of $5,586.54. We consumed 735 tons and 600 pounds of anthracite pea coal, at a cost of $2,933.85, a difference of $2,652.69, not considering the kind of fuel. They expended $32,000 in new pumps, and they are inadequate; we invested $38,000 in meters, of which we have already saved over 44 per cent. in their cost on the fuel, and will increase that saving from year to year. When fire pressure is demanded of us, the water is not oozing from a thousand and one openings, reducing our pressure, crippling our usefulness, and weakening us when demand is made upon us in case of a large conflagration. The free-water people forget that they are standing in their own light and are paying for this free water indirectly and might be so unfortunate as to suffer a great loss by fire through the want of fire pressure.

METER RATES.

Another very difficult problem to solve is that of meter rates. We have made the rates a study for years. With the best intentions, we are bound to do injustice to some; therefore our endeavors should be in the direction of the least possible injustice. The three most difficult, and at times very expensive, parts to be considered are the source of supply, filtration, and the fuel. Our water supply is from artesian wells; therefore, filtration is not in our consideration, but the fuel bill plays an important part. Our pumping station being located in the residence portion, in the midst of a park, surrounded by costly dwellings, we are compelled to use hard coal. The average cost of our coal for the past ten years has been $5.25 per ton. Our annual operating expenses average between eleven and twelve thousand dollars. Therefore, with the above considerations in view, we fixed our meter rates. First, we established a minimum rate. Second, we decided that every taker, whether large or small, should pay for the first 5,000 cubic feet the same rate; after that a sliding scale for the benefit of the larger takers and in proportion to the use, viz.: If a party consumes 90,000 c. f.

in six months he pays for the first 5,000 c. f., $10; for 10,000 c. f., $15; for 20,000 c. f., $25; for 30,000 c. f., $30; for 40,000 c. f., $33; for 50,000 c. f., $36; for 60,000 c. f., $39; for 70,000 c. f., $41; for 80,000 c. f., $43; for 90,000 c. f. $45; all over 90,000 c. f., at 5 cents per 100 cubic feet. Having only one large factory that consumes a large amount of water, and our city being of a resident population, we cannot sell water less than 5 cents per 100 cubic feet at the present time. We sell by the cubic foot because it is indicated so on the meter; the takers can read the registration and govern themselves accordingly. Our rates are:

First 5,000 cubic feet or less, per six months, per hundred cubic feet, 20 cents.

Over 5,000 cubic feet and up to 20,000 cubic feet, per six months, add $10.00 for first 5,000 cubic feet and 10 cents for each additional 100 cubic feet.

Over 20,000 cubic feet and up to 30,000 cubic feet, per six months, add $25.00 for first 20,000 cubic feet and 5 cents for each additional 100 cubic feet.

Over 30,000 cubic feet and up to 60,000 cubic feet, per six months, add $30.00 for first 30,000 cubic feet and 3 cents for each additional 100 cubic feet.

Over 60,000 cubic feet and up to 90,000 cubic feet, per six months, add $39.00 for first 60,000 cubic feet and 2 cents for each additional 100 cubic feet.

Over 90,000 cubic feet, per six months, per 100 cubic feet, 5 cents.

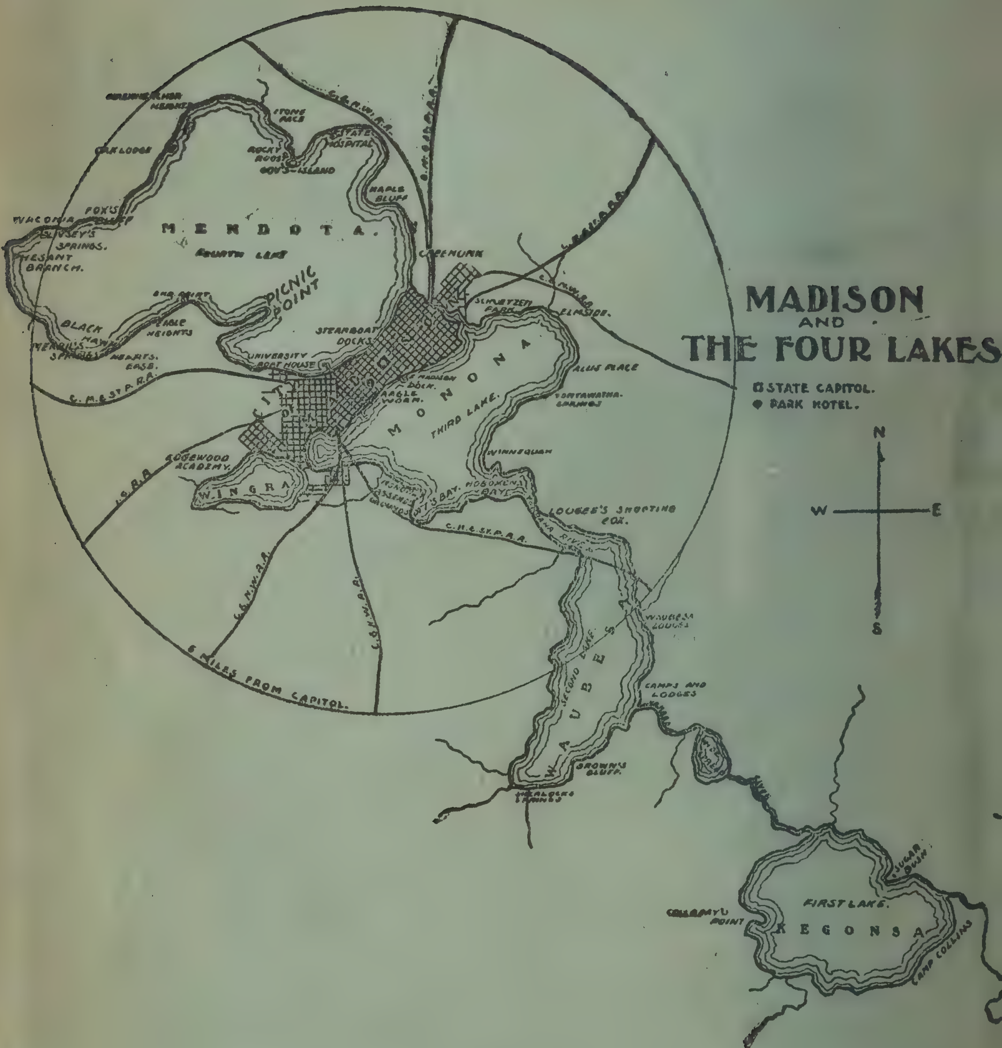
Minimum, per six months, $2.25.

The method of figuring under these rates is very simple, as examples will show, to wit: A patron having consumed during six months 7,316 cubic feet, deduct the first 5,000 c. f., which cost $10.00, multiply 2,316 c. f. by 10 cents, $2.32, add the $10.00, and the bill is $12.32. If he consumed 16,789 c. f., deduct 5,000 c. f., multiply 11,789 by 10 cents, $11.79, add $10.00 = $21.79. If 26,382 c. f., deduct 20,000, which leaves 6,382 c. f. at 5 cents 100 c. f., $3.19, add $25.00, and the bill is $28.19. If 50,110 c. f., deduct 30,000 c. f., multiply by 3 cents, $6.03, add $30.00 = $36.03. If 78,999 c. f., deduct 60,000 c. f., leaves 18,999 c. f. at 2 cents 100 c. f., $3.80, add $39.00 = $42.80. You will note that by this method every cubic foot is considered and the assistance given to the larger taker according to his business and demands.

We adopted these rates two years ago, and they have been very satisfactory and met with general approval. There is the least discrimination, and no encouragement to waste water to get a lower rate. Our experience has taught us that there ought not to be a flat rate. If each taker, whether large or small, had to pay the same rate, it would be a gross discrimination against the larger taker, and result in a deficit in the exchequer, and, necessarily, higher rates; whereas with a sliding scale all are treated as nearly as possible impartially. If there was only one price in the fuel, per ton of coal or cord of wood; that is to say, if we had to pay for 600–800–1,000 or more tons of coal or cords of wood to pump the water the same price that it costs us for our own private use, what would be the result? Who would pay the difference? Would not the taker? The small as well as the large taker derives the benefit of the lower cost of fuel. There must be a minimum rate, as it costs as much to take care of a small as it does of a large consumer. If we purchase a half ton of coal, the cartage is the same, and the labor nearly so, as if we had purchased two tons. It is so in all commercial lines; why should it be different in the sale of water?

I trust that I have added in a small way another solution of the great problem that baffles so many water works officials — that of securing an abundance of water at a lower cost, lower in the avoidance of the purchase of pumping machinery, lower in the cost of filtering the supply, and better able to secure a pure and wholesome water from artesian wells in smaller cities. The meter is the detective, the guardian, the adjuster, the salvation of the water supply and of the finances. A thorough trial of the meter by water works officials and by the citizens will soon convince them that the only fair and just way to sell water is by meter measurement.


MAP OF THE
WATER WORKS SYSTEM
OF
MADISON
WISCONSIN.
JOHN B. HEIM, Supt
EXPLANATION:
Represents 2 in. Pipe
Hydrants
Valves
Wells
PROJECTED LINES IN RED
PRESSURE AT HYDRANT IN RED FIGURES
SUCTION PIPE IN RED
LAKE MENDOTA
LAKE MONONA
LAKE WINGRA
UNIVERSITY GROUNDS
BROOKS ADDITION
UNIVERSITY ADDITION
BOWEN'S ADDITION
GREENBUSH ADDITION
WRIGHT'S ADD.
WARRENS ADDITION
SOUTH MADISON
ORTON PARK
BADGER
WILLARD PARK
ADDITION
STATE CAPITOL
1st Wd.
2nd Wd.
3rd Wd.
4th Wd.
5th Wd.
6th Wd.
7th Wd.
8th Wd.
WASHINGTON AVE.
CHICAGO AND NORTH-WESTERN
CHICAGO MILWAUKEE & ST. PAUL
CHICAGO MADISON & NORTHERN
SCALE
10 Chains to an Inch


MADISON
AND
THE FOUR LAKES
STATE CAPITOL.
PARK HOTEL.
N
S
W
E
MENDOTA.
FOURTH LAKE
PICNIC POINT
MONONA
THIRD LAKE.
WINGRA
WAUBESA
SECOND LAKE
KEGONSA
FIRST LAKE.
MAPLE BLUFF
STATE HOSPITAL
STONE RACE
ROCKY ROOST
FOX'S BLUFF
SPRINGS.
BRANCH.
BLACK HAWK
EAGLE HEIGHTS
STEAMBOAT DOCKS
UNIVERSITY BOAT HOUSE
EDGEWOOD ACADEMY.
WINNEQUAH
LOUGEE'S SHOOTING BOX.
CAMPS AND LODGES
BROWN'S BLUFF.
SUGAR BUSH
CAMP COLLINS
ELMSIDE.
C. M. & ST. P. R.R.
C. & N. W. R.R.
6 MILES FROM CAPITOL.

17th

Annual Report

of the

Bd. of Water Commissioners

of

Madison

For the

Year Ending September 30, 1899

Compliments of

John B. Heim

Superintendent.

WATER WORKS PUMPING STATION.

SEVENTEENTH ANNUAL REPORT

OF THE

Board of Water Commissioners

OF THE

CITY OF MADISON

For the Year Ending September 30, 1899

TOGETHER WITH

REPORTS OF THE SUPERINTENDENT AND SECRETARY.

MADISON
Democrat Printing Company, City Printer
1900

LIST OF WATER COMMISSIONERS [1]

Under whose charge the Water Works was placed, and time served.

COMMISSIONERS.

* James Conklin	1884-5-6-7-8-9
* H. Christoffers	1884-5-6-7-8-9-90-1-2-3-4
R. M. Bashford[2]	1884-5-6
John Lamont[3]	1886-7-8-9-90-1-2-3
A. Donovan	1889-90-1-2
John R. Melvin	1892-3-4-5-6-7-8
W. W. Warner	1893-4-5-6
J. J. Silbernagel	1894-5-6-7-8
J. Van Etta	1896-7-8

EX-OFFICIO.

* H. N. Moulton,[4] Mayor	1885-6
A. Donovan, Alderman	1885-6
E. W. Keyes, Mayor	1886-7
M. J. Cantwell, Alderman	1886-7
* James Conklin, Mayor	1887-8
G. J. Corscot, Alderman	1887-8
M. R. Doyon, Mayor	1888-9
S. G. Oakey, Alderman	1888-9
M. R. Doyon, Mayor	1889-90
E. L. Baker,[5] Alderman	1889-90
F. C. Sheasby,[6] Alderman	1889-90
R. M. Bashford, Mayor	1890-1
H. Schulkamp, Alderman	1890-1
W. H. Rogers, Mayor	1891-2-3
H. Schulkamp, Ald'man	1891-2-3
John Corscot, Mayor	1893-4
R. F. Taylor, Alderman	1893-4
John Corscot, Mayor	1894-5
W. C. Noe, Alderman	1894-5
Jabe Alford, Mayor	1895-6
W. H. Lansing, Alderman	1895-6
A. A. Dye, Mayor	1896-7
Edward Quammen, Ald'm'n.	1896-7
M. J. Hoven, Mayor	1897-8
Edward Quammen, Ald'man.	1897-8
Chas. E. Whelan, Mayor	1898-9
Edward Quammen, Ald'man.	1898-9
M. J. Hoven, Mayor	1899-1900
Edw. Quammen, Ald'm'n.	1899-1900

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1 First Commissioners elected April 15, 1884.

2 Resigned March 1, 1886.

3 Elected to fill vacancy.

4 Mayor and Alderman ex-officio added to Board April, 1885.

5 Resigned.

6 Elected to fill vacancy.

* Deceased.

OFFICERS OF THE WATER WORKS.

JOHN R. MELVIN, President . . .	Term expires October 1, 1901.
J. J. SILBERNAGEL	Term expires October 1, 1900.
J. VAN ETTA	Term expires October 1, 1902.
M. J. HOVEN	Mayor, *ex-officio*.
EDWARD QUAMMEN	Alderman, *ex-officio*.

O. S. NORSMAN, Secretary.

SUPERINTENDENT,

JOHN B. HEIM.

METER INSPECTORS,

NICHOLAS REIF,

FRANK T. HAYES.

ENGINEERS,

PETER GAUER,

DENNIS DACEY,

AUSTIN GANNON.

FIREMEN,

JOHN LYONS,

PATRICK DORIS.

WATER WORKS OFFICE.

CITY HALL, SECOND FLOOR.

Regular meetings of the board Wednesday previous to common council meeting of each month at 3 o'clock p. m.

All bills against the Department must be rendered on or before the 28th of each month, or they will lie over until the following regular meeting.

Water rents are due and payable, in advance, at the office of the City Treasurer, on the first days of January and July of each year.

CITY ORDINANCE.

"*All water rents shall be paid semi-annually, the first days of January and July of each year, in advance; any water rents, whether by schedule or meter*, which shall not be paid within thirty days after the same become due and payable, shall be increased by a penalty of ten per cent, and if the same shall not be paid, together with the penalty thereto attached, within ten days after the same become due and payable, the water shall be shut off from the consumer so in default."

REPORT OF THE COMMISSIONERS.

Office of the Board of Water Commissioners,
City of Madison, Wis.,
February 12, 1900.

To the Honorable Mayor and Common Council of the City of Madison:

In compliance with the requirements of the city charter we have the honor to submit herewith the seventeenth annual report of the water works department of this city, covering its operations during the year which ended on the thirtieth day of September, 1899.

The superintendent's report goes over the year's work in detail, and we respectfully ask your careful perusal and consideration thereof. The income of the department, aside from the $3,000 received from the tax levy 1898 was $23,879.50, while the expenditures for operating, construction and repairs were $20,209.21, leaving a nice little balance on the right side of the department ledger. The operating expenses were only a trifle larger than the year before, while the construction expenses were curtailed, as the superintendent states, with a view to saving up money for the purchase of new pumping machinery, the need of which he again urges most strongly upon us. The increase in the item of repairs is due, as the superintendent states, to extraordinary expenditures made necessary by the long continued extremely cold weather of last winter, and to the cost of lowering mains where this was found absolutely necessary in order to prevent a recurrence of the troubles experienced by the department at that time.

The superintendent recommends a number of extensions of the water mains, to keep pace with the growth of the city, and we concur with him in his statement that these ought to be made the coming season.

We deem it fitting and proper to refer in this report to the death, which occurred during the past year, of Hon. James Conklin, whose eminent services to the city in general, and to this department in particular, will ever be held in grateful remembrance by an appreciative public. Mr. Conklin was closely connected with the construction of the water works, having been mayor of the city, both during the agitation which led up to the construction of the plant by the city, and at the time when it was completed. After the management was placed in the hands of the Board of Water Commissioners, Mr. Conklin served as member of said board for six years. During this whole period he was the president of the board. Great credit is due him for the interest he manifested and for the work he did, in the establishment of this municipal enterprise, and we desire here to publicly express our appreciation of the great work which he gratuitously performed during those years in behalf of the city, and particularly this department.

We also desire to commemorate the services rendered the city and the water department, by the late Henry Christoffers, as a member of the first Board of Water Commissioners, and who served continuously for a period of ten years.

As a further mark of respect we have procured excellent portraits of both, which appear in this report.

Respectfully submitted,

J. R. MELVIN,
J. J. SILBERNAGEL,
J. VAN ETTA,
M. J. HOVEN,
ED. QUAMMEN.
Commissioners.

JAMES CONKLIN
Mayor during the construction of the water works, 1881-2-3.
Water Commissioner, 1884 to 1889.

SECRETARY'S STATEMENT

Of receipts and expenditures of the water department, city of Madison, for the year ending Sept. 30, 1899.

RECEIPTS.

Balance Oct. 1, 1898	$4,883 65	
Water rents collected	23,392 12	
Water permits collected	254 00	
Miscellaneous receipts	228 38	
Plumbers' license	5 00	
Received from tax of 1898	3,000 00	

EXPENDITURES.

Construction expenses		$6,181 74
Operating expenses		11,122 33
Repair expenses		2,905 14
Transferred to bond fund		5,000 00
Balance on hand Oct. 1, 1899		6,553 94
	$31,763 15	$31,763 15

MISCELLANEOUS.

Total receipts from water rents from construction of works to Oct 1, 1899	$259,078 82
Total receipts, water permits, same period	5,368 00
Total operating expenses to Oct. 1, 1899	160,586 94
Total cost of construction and extensions	329,400 31
Total cost of repairs to Oct. 1, 1899	10,255 84
Cost of new boilers put in 1897	3,675 00
Amount of bonds issued for construction of plant	76,000 00
Amount of this issue now outstanding	8,000 00
Water works extension bonds issued in 1893	10,000 00
Total amount of water bonds outstanding	18,000 00

Respectfully submitted,

O. S. NORSMAN,

Secretary.

SUPERINTENDENT'S REPORT.

Madison, Wis., February 7, 1900.

To the Honorable the Board of Water Commissioners:

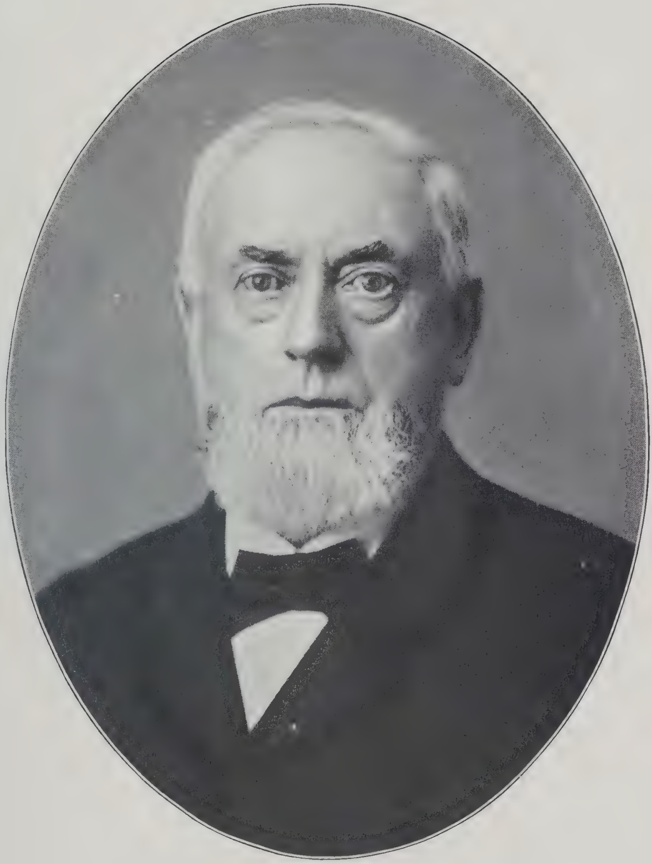
Gentlemen: — In compliance with the city ordinance, I present herewith the seventeenth annual report of the operations of the Water Department, showing the receipts, expenditures, extensions and improvements made during the past year, with such recommendations as I think actually necessary.

FINANCIAL.

As will be seen by glancing over the statement of the secretary, the financial condition of the department is more than gratifying, not only to your honorable body, to whom this part of the city government is entrusted, but also to the citizens of Madison. The water works is a self-sustaining institution. The water department is conducted with its own earnings. After paying all its running expenses, including construction, extensions and repairs we had a cash balance on hand for the fiscal year ending September 30, 1899, of $6,553.94.

The receipts during the year were $31,529.77. These include a balance on hand October 1, 1898, of $4,883.65 and $3,000 derived from the tax levy of 1898, for the payment of the bonded indebtedness.

The expenditures for the year was $25,209.21. This includes $5,000 ($3,000 from tax levy and $2,000 from water rents) transferred to the bond fund, construction, the extension, operations and repairs. The total indedtedness is $18,000. This consists of the original bonds, $8,000 which become due April 1st, 1902, and $10,000 extension bonds of 1893.



HENRY CHRISTOFFERS
Water Commissioner, 1884 to 1894.

PUMPING MACHINERY.

I must again call your attention to the necessity in the immediate future for new pumps. The action on your part should not be delayed beyond the current year. We have a combination of engines and pumps. The engines are in splendid condition, but the action of our mineral water is gradually destroying the inner parts of the pumps. The life seems to be fairly drawn out of the iron in the pressure chambers of the pumps, wherever the water comes in contact with the iron. The pump chambers have been reduced to 75 per cent. of their original thickness. During the past year the pump chambers of the smaller pumps cracked twice, which we had re-enforced with steel bolts. The pump chamber in one of the larger pumps one piece had two breaks. This we had replaced. The weight of this piece of iron is about 500 pounds. Whenever we repair or overhaul the pumps, we find the iron is reduced, in parts it seems to graphite. With an ordinary chisel or knife we can dig into the iron to a certain depth, showing that the action of the water is gradually penetrating, thus doing its mischievous work.

The chief engineer is fearful, that, under a high fire pressure, which is liable to happen at any time, the pumps may collapse. Notwithstanding that the pumps appear to the ordinary laymen good and sound, still the danger is there, and must be avoided.

Your honorable body ought to take steps at once to prepare plans and specifications for new pumps.

In the specification of the new pumps special attention should be given that the construction of the inner parts should be of such material that will withstand the action of the water's destruction. The pumps ought to be of the modern triple expansion type, and the fore and aft marine style. An engine of this type will be very economical, between 35 and 40 pounds of coal will perform the same duty

that 100 pounds perform with the present machinery. The saving in the fuel at the present price of coal would amount to at least $1,800 per annum. The pumps should be placed 9½ feet lower than the present pumps, and in conformity with new suction main. By doing this, we will increase our present water supply from the present wells at least 40 per cent. This means, that, with the general meter system, our present wells will furnish water for an increased population up to 40,000 inhabitants.

IMPROVEMENTS.

It is always a pleasure to find, that, after you have added improvements, according to your own investigation, and judgment, you have made no mistake. Such is the case with the new boilers; they give splendid satisfaction and are a saving in fuel. Notwithstanding the past year was the most trying ever experienced since the construction of the water works, with the old non-condensing pumping machinery, an increase in pumpage of 18,917,750 gallons of water, and an increase in water takers, we consumed fifteen ton of coal less than last year. This also means 42 pounds of coal less for each taker over 1898. The same holds good with our own electric light plant. The running expense during the past year was $22.43 for oil and lamps, $15.14 less than in 1898. The blow-off from the boilers gave us constant trouble on account of a dip made by the city in the blow-off pipe by lowering a culvert that passed over the pipe. This blow-off pipe we changed entirely carrying it into the culvert that extends into Lake Mendota. The trouble has ceased.

FROZEN WATER PIPES.

The unprecedented winter of 1898-99 is still fresh in our minds. A winter that was trying and dangerous on all water works systems throughout the country. Hardly a city escaped without having some of the water mains frozen. In this latitude but few escaped.

A continuous cold spell, lasting 82 days, the thermometer never rising during during this period above the freezing point, and registering 26 and 28 degrees below zero, carried the frost below many of our mains. The covering of our water mains laid originally by contract, is five feet. Those laid since by the department, six feet. It was only by continuous watching, both day and night; flushing the mains at the extreme ends, thus keeping the water continuously moving that prevented the mains from freezing. In Greenbush at the corner of Mills and Mound streets, we had a hydrant running continuously for three weeks, there being 6,930 feet of pipe with only fifteen takers, insufficient to keep the water moving. When the warm spell set in, the frost went deeper, many of the service connections were caught, that had escaped up to this time. We at once carried on a continuous flushing all over the city, to save our mains. By these precautions we luckily averted the freezing of our mains. During the cold period we examined every hydrant, to be prepared in case of a fire. A call was made upon us February 10th at 3 a. m. the temperature registering 25 below zero at Washburn observatory at midnight and 6 o'clock a. m. We were prepared and furnished 24,000 gallons of water. The call was box 45,—446 W. Main St. It seems that our city was one of the few cities in and out of the state that escaped Jack Frost and saved the great expense of replacing broken water mains. The service connections were not so lucky. If the same care had been taken by the takers as we did with the mains, but very few would have frozen.

About 400 services were frozen, scattered all over the city. Calls were made on us incessantly to thaw out services, but we refused, it being no fault of the city. The freezing was here and there. Take for instance Langdon street, over 3,300 feet long, with 71 takers, only ten services were frozen, averaging two to a block. Another instance: Why will one service freeze which is only sep-

arated from its neighbor by several feet and the other not? or where the taps in the street are only one foot apart, the party on the opposite side getting water? The fault certainly does not lie with the city. During the spring and summer of the present year, whenever an opportunity presented itself, I had an examination made of services that were frozen, as to their depth in the street, and found only in a few instances where they were not to the required depth. We found that most invariably the fault was between the curb and the house. Where the service pipe in the street was from 5½ to over 6 feet deep, under the sidewalk it was only 1 foot 9 inches, 2 foot 3 inches, and 3 to four feet deep in the several instances. We found a service on East Johnson street where the service in the street was 6½ feet deep, under the sidewalk the plumber had left a tunnel that required a large load of dirt to fill the opening. This service was one of the first to freeze and did not thaw out until May.

These examinations proved that the city took the correct stand in refusing to thaw out services. The citizens at large ought not to be compelled to pay for the negligence of their fellow neighbors or plumbers. On the 13th of February, 1899, Professors Jackson and Wood of the State University, succeeded in thawing frozen water pipes by electricity. The full description and success is given in the paper prepared and read by the Superintendent at the convention of the American Water Works Association, held at Columbus, Ohio, May 16 to 19, 1899, and is appended to this report.

LOWERING OF MAINS.

During the past season we lowered the water mains and services on Clymer street between Bassett street and Bedford street, Butler street between Washington avenue and Mifflin street, Langdon street between Francis street and Wisconsin avenue, and Dayton street between Baldwin

street and Dickinson street. These streets were macadamized within the last ten years. These water mains were laid by Contractor M. Philbin & Co. in 1882, according to the established grade given by the city engineer, A. D. Conover. The city paid the contractor under date of November 4, 1882, for the extra depth in trenching, wherever grading would have to be done in the future, the sum of $500 over and above his contract price.

The water department has been criticised for not laying the mains deep enough, or lowering them before the macadamizing was done. The department did not and could not know that the grade on these streets had been changed without receiving such information from the city engineer, where cutting would be done to endanger the mains, and therefore it ought not to be criticised.

Two members of the present water board and the undersigned being members of the Waterworks Construction committee in 1881-2, were especially instrumental to see that the mains should and were laid extra deep where there was any likelihood of cutting to be done thereafter. We were not aware that no attention had been paid to the established grade of 1882.

On East Dayton street above mentioned we found the main in front of lots 1 to 4 and 15 to 18 only from 3 to 4 feet deep. The close proximity of this main to the Fuller & Johnson works and the continuous flushing is what saved it from freezing, as also the main on East Gorham street between Blair and Blount streets, we found in same condition, at a point only 3 feet deep. (We were not able to lower this main the past year.) The close proximity to the station saved this main from freezing last winter. Some attention ought to be paid to what pipes are below the surface, and if no heed is paid to previous established grades, the water department ought to be informed of such fact, to be able to lower the mains before macadamizing is done, when it is less expensive, and before any damage

has been done. We also lowered the main on Ingersoll street between Jenifer and Williamson street, also the hydrants at the corner of Brearly and Gorham streets, Dayton and Baldwin streets, Johnson and Broom streets and Johnson and Charter streets.

ELECTROLYSIS

affects our service pipes still between the danger line from Franklin to Blount streets in front of the power house. We had to replace several lead pipe services the past year. The pipe that we removed at the switch near the East Madison depot fell all to pieces, parts of it were just like so much ashes. We have bonded the water main with the track for a return current at different points, but it seems it does not overcome the electrolitic action. The electric company ought to bear the extra expense of renewing these services.

SPRINKLING VALVES.

Following your approval of our recommendation for a change in the use of the hydrants for street sprinkling purposes, we purchased and attached 55 valves to the hydrants for the street sprinklers. We feel that we struck the right keynote. Our hydrant repair expense has been reduced considerable, the life of the hydrants extended, and in proper condition in case of a fire during a continuous cold spell. The expense incurred will be saved in a few years. These sprinkling valves are somewhat of a nuisance on account of the careless handling of the street sprinklers, but we had better contend with that, than to have hydrants out of order.

HYDRANTS.

The most delicate and essential part of the water works system are the fire hydrants. We are ever anxious and on the alert to see that they are in working order, and to save them, the sprinkling valves were attached; still with

all our care we are handicapped. Our plant being owned by the city, it seems that the employes of the city deem it their special privilege to handle the hydrants without the permission of the water department. Whenever a sewer or culvert seems to be or is clogged, the hydrant is the temptation, and is used for flushing, and this is done, whether above or below zero, and at times when our help is forbidden to open a hydrant who have done this work for years.

Some day we may have to suffer for this carelessness. A fire may occur in the business or densely populated portion of the city, where this misuse mostly occurs, and we will be unable to avert a large conflagration on account of a hydrant being out of working order. The water department will be accused of what they are unable to avoid. The street department ought to employ one man and one man only, to attend to the hydrants, and be held responsible. The water department should be notified when and where the hydrant is to be used, and when the work is accomplished.

The hydrants around the capitol square were moved further inward towards the capitol park to conform with the widening of the streets, to be covered with asphalt the coming season.

We also moved the hydrants on West Washington avenue to conform with the narrowing of the same.

METERS.

During the past year we increased our meters from 2,269 to 2,410, an increase of 141, being 133 new and eight old takers, leaving still 180 takers without meters. These takers are not connected with the sewer system. Whenever connections are made, they will be placed under the meter system.

The total amount expended up to September 30, 1899, for meters of all sizes, (the city furnishing the meters free in-

cluding the meter boxes,) and the placing of the meters by the department free in 1888–89, was $41,491.93, an average of $17.21⅔ per meter.

The total amount of water pumped the past year was 291,934,250 gallons against 273,016,500 gallons the previous year, being 18,917,750 gallons more.

The total amount of water that passed through the meters the past year was 97,131,635 gallons for which the city received $20,406.44, an average of each taker of $8.42. The per capita for these 2,410 takers that received their water through meters, including the Fuller & Johnson Manufacturing Co., Gisholt Machine Co., both with large forces of men, and the hotels and large number of boarding houses, averaging only at 6 per taker, would amount to 18 gallons per day.

Allowing an annual average use of water for the 180 takers without meters as furnished through meters would mean 7,254,630 gallons.

On account of the extreme cold weather, with the extra flushing, and continuous flow of water of mains and private services, notwithstanding that over 400 services were frozen, we pumped 23,877,500 gallons more water during the months of January, February, March and April than we did during the same months of 1898; 907,100 gallons of water was furnished for fire purposes leaving a balance of 129,170,865 gallons of free water, including flushing of mains during eight months and waste in laying of new mains.

If we consider all water pumped the per capita for the past year will be 44½ gallons; if we deduct the great waste during four months of 23,877,500 gallons the per capita is only 40⅔ gallons.

The average cost of operation for each taker, the past year exclusive of the interest of the investment was $4.27.

Nine hundred and seventy-seven water takers paid only the minimum rate of $2.25 at the January, and 1,099 takers paid only the minimum rate of $2.25 at the July rent day.

The meter repairs for the past year exclusive of the unusual number of meters that were broken by frost, was $68.70. Every meter repaired is retested as correct as possible and must not register more than 2 per cent. against the city before again being placed.

For a fair illustration of the benefit of a general meter system instead of schedule rates that the city would not be at a pecuniary loss, even if the meter was registering 15 per cent. and over against the city, we will cite you one of many cases.

A tenement rated under the schedule rate of $10.50 per annum paid as low as the minimum of $2.25 in six months and as high as $6.45 for six months. Another family moved in and increased the water bill to $23.40 in one month, everything wide open claiming that they had lived in Chicago with no meter attached allowing the water to run continuously not aware of a meter in these premises registering their waste. The party still insisted in letting the water run part of the time in the water closet, and made a bill in four months amounting to $30.25.

Will mention another case, with the same circumstance, a bill of $19.78 in one month.

To again show the benefit of the meter system is in the saving of fuel. The past year we consumed 548 pounds of coal against 1,731 pounds in 1884–5 for each taker, a saving of $5,919.17. The saving in 1897–8 was $5,393.91. The saving in 1896–7 was $5,163.87, a total of $16,476.95 the past three years. The previous saving in fuel back to the year 1888 when we adopted the meter system was $21,655.21, being a sum total of $38,132.16. only $3,359.77 less than the original cost of the meters. A splendid showing of the workings of a general meter system in ten years. Another year will cover the cost of the meters and the interest on the same for the eleven years.

The following table shows the number of meters in use for each year since October 1, 1884, the amount of water

pumped, coal consumed, the population and the per capita, based on all water pumped:

Year.	Population.	No. of takers	No. of meters.	Gallons water per year.	Gallons water per day.	Pounds coal per year.	Pounds coal per day.	Gall'ns per capita.
1884-85.	11,325	699	3	199,333,840	546,120	1,210,150	3,315	48
1885-86.	12,063	876	5	236,649,850	648,355	1,339,900	3,671	53
1886-87.	12,063	980	5	261,308,160	715,885	1,124,200	3,123	59
1887-88.	12,063	1,099	210	257,682,300	704,050	1,047,200	2,861	58
1888-89.	12,063	1,229	385	195,450,770	535,480	914,500	2,540	44
1889-90.	12,063	1,355	441	190,810,910	520,030	1,331,500	3,648	43
	Census 1890.							
1890-91.	13,246	1,405	498	197,889,450	542,162	1,044,000	2,860	38
1891-92.	13,246	1,554	547	236,035,800	646,753	1,173,100	3,214	47
1892-93.	13,246	1,701	673	268,246,300	734,921	1,302,200	3,567	50
1893-94.	13,246	1,820	795	272,006,950	745,224	1,393,800	3,819	48
	Census 1895.							
1894,95.	15,950	1,994	1,223	313,705,500	859,467	1,514,400	4,152	53
	School census.							
1895-96.	17,884	2,186	1,726	325,408,500	891,530	1,558,000	4,268	50
1896-97.	17,884	2,334	2,071	290,972,750	797,186	1,470,600	4,029	45
1897-98.	17,884	2,473	2,269	273,016,500	750,730	1,470,200	4,028	41½
1898-99.	17,884	2,606	2,410	291,934,250	799,819	1,440,000	3,945	40⅘44½

The following table shows the number, size and kind of meters in use October 1, 1899:

Kind.	⅝ in.	¾ in.	1 in.	2 in.	3 in.
Crown	1,718	68	15	2	....
Hersey	224	128	4	2	....
Thomson	115	....	....	....	....
Westinghouse	28	....	....	....	....
Union	20	....	....	....	....
Nash	2	2	....	....	....
Neptune	79	....	....	....	....
Worthington	....	2	....	....	1
	2,186	200	19	4	1

WATER PERMITS.

During the year we issued 133 original water permits, making the total takers September 30, 1899, 2,606.

We can easily calculate on an average of six per taker, which would mean 15,636 citizens that are using the city water. For the last four or five years we have added to our list a great many citizens who were loath to part with their wells. If this rate continues every citizen in Madison will soon use the city water.

WATER RENTS.

The annual revenue from the 2,606 water consumers was \$23,392.12; from permits, \$254; a total of \$23,646.12. This is not up to the average increase on account of the many services frozen and allowances made in the water bills of a continuous flow of water to prevent services from freezing. The average for each taker was \$8.97½.

OPERATING EXPENSES.

The operating expenses for the year ending September 30, 1899, were \$11,122.33, \$117.89 more than the previous year. This is accounted for in the extra labor account during the cold spell, and the refitting of the new water office. Still with the saving of coal over the previous year, the expense amounts to 17½ cents less per taker than in 1897-8.

We have also arranged the delivery of coal, to commence with the beginning of the next fiscal year, 1899–1900, so that the coal bills do not lap over into the next year, enabling us to confine the operating expenses in its proper year, thereby avoiding the variation of this item annually. C. F. Cooley furnished the anthracite pea coal for the year, he being the lowest bidder at \$3.50 per ton. The net receipts from water rents over and above the operating expenses the past year were \$12,269.79.

CONSTRUCTION EXPENSES.

The expense of constructions, extension, service connections and meters for the year was only \$6,181.74,— the lowest in the history of the water works.

We have limited our expenses preparatory to purchasing new pumping machinery. The repairs interfered somewhat with our calculations.

REPAIRS.

The repairs during the year amounted to \$2,905.14, being the highest of any year. The cause was, the lowering of

the different water mains and the replacing of the broken mains on Clymer and Johnson streets.

SERVICE CONNECTIONS.

During the past year we laid 2,716 feet of lead services which brings the number of feet of extra strong lead service pipe laid to curbstone to 69,422 feet or $13\frac{1002}{5280}$ miles of pipe. We also laid 2,533 feet of lead services to the curbstone wherever possible before the streets were macadamized to prevent tearing up of streets when called for.

On West Washington avenue we laid a service connection for every 33 feet, as those lots are all calculated to be sold with that number of feet frontage.

Thus far we have laid 16,055 feet of lead services to curb which are not included in the summing up of the actual services in use.

These 16,055 feet mean 417 taps to be connected with when applications are made.

The following tables show on what streets service pipes were laid the past year, for new takers and those ready for connection, giving size, number of feet on each street or avenue, and the total:

Table showing services laid for new takers.

Streets and Avenues.	⅝ inch.	¾ inch.	1 inch.	Total.
Baldwin street	67	....	....	67
Bassett street	48	....	....	48
Blair street	19	....	....	19
Blount street	86	....	....	86
Broom street	58	....	....	58
Bruen street	67	....	....	67
Carroll street	19	....	....	19
Dayton street	212	....	....	212
Dickinson street	58	....	....	58
Few street	29	....	....	29
Frances street	48	40	....	88
Gilman street	39	....	....	39
Gorham street	125	....	....	125
Hancock street	58	....	....	58
Hamilton street	29	....	....	29
Henry street	19	....	....	19
Jenifer street	154	....	....	154
Johnson street	173	....	....	173
King street	29	....	....	29
Livingston street	48	....	....	48
Main street	144	....	....	144
Mifflin street	250	....	....	250
Mills street	38	....	....	38
Monona street	13	....	....	13
Rogers street	29	....	....	29
Pinckney street	41	....	....	41
Sherman avenue	115	....	....	115
Spaight street	77	....	....	77
Spring street	19	....	....	19
State street	19	....	....	19
University avenue	62	....	....	62
West Washington avenue	87	....	62	149
Williamson street	289	....	....	289
Wisconsin avenue	....	46	....	46
Total	2,568	86	62	2,716

Table showing services laid to curbstone before macadamizing of streets to prevent tearing up for connections hereafter.

Streets and Avenues.	Number of taps.	Size, ⅝ inch.	1 inch.	Number of feet.
Bruen street	3	67	....	67
Dayton street	13	297	....	297
Hamilton street	7	124	115	239
Ingersoll street	5	125	....	125
Mifflin street	2	38	....	38
State street	2	26	....	26
Warren street	13	297	....	297
W. Washington avenue	38	1,444	....	1,444
Total	83	2,418	115	2,533

NEW MAINS.

During the year we laid 2,552 feet of four-inch and 440 feet of six-inch cast iron pipe and placed two hydrants and eight valves.

The following table shows the extensions made during the year, giving size laid, number of feet, and where hydrants and valves were placed:

Streets and Avenue.	Cast Iron Pipe.		Hydrants.	Valves.
	4 inch.	6 inch.		
Bedford street	535	....	....	2 4-inch.
S. Hamilton street	495	....	....	1 4-inch.
E. Main street	492	....	1 4-inch.	1 4-inch.
S. Patterson street	330	....	1 4-inch.	1 4-inch.
Williamson street	....	440	1 4-inch.	1 6-inch.
E. Wilson street	660	....	....	1 4-inch.
W. Wilson street	370	....	....	3 4-inch.
W. Washington avenue	....	....	....	1 6-inch.
Total	2,882	440	3	11

The valves placed on West Washington avenue and West Wilson street was to shorten the districts in cutting off water from the main.

The total mileage of water mains is $33\frac{1997}{5280}$ miles, 164 hydrants, 228 valves, 5,735 feet of suction main from wells (with which are connected 17 valves aside from the valves in the water mains), and 1,564 feet of lead mains.

Would again recommend that a main be laid on Baldwin street to connect the dead end of Sherman avenue with Gorham street. This cannot be done unless the common council will grade the street to prevent the main from freezing.

Would further recommend that we connect this year, if possible, Frances street with Lake street through Mendota court, and Wilson street through Monona street, with Main street, to do away with the temporary lead mains, which are a continuous expense in repairing.

The main on Williamson street ought to be carried under and across the Yahara river the coming season. With this work accomplished and new pumping machinery placed, we will be ready, to extend the water main on Winnebago street from Yahara river to the city limits and return on East Washington avenue to connect at Dickinson street in 1901.

PUMPAGE RECORD.

Monthly record of the amount of water pumped and coal consumed during the year.

(Prepared by Chief Engineer Peter Gauer.)

Months.	Gallons of water pumped.	Revolution of large engine.	Revolution of small engine.	Average steam pressure.	Average water pressure.	Average vacuum	Pounds of coal consumed.	Net combustible.	Ashes.	Duty in foot lbs. per 100 lbs. net combustibles.
October, 1898.....	20,076,250	191,500	1,248,500	90	92	18	105,600	88,704	16,896	42,358,050
November, 1898...	16,762,250	....	1,341,000	90	92	16	97,200	81,648	15,552	37,836,608
December, 1898...	18,618,750	....	1,489,500	90	92	17	102,300	85,932	16,368	38,808,190
January, 1899.....	26,961,250	977,500	436,500	90	92	20	123,300	103,572	19,728	48,259,827
February, 1899....	27,227,000	878,500	632,000	90	92	21	140,100	117,684	22,416	46,236,160
March, 1899......	29,100,000	....	2,328,000	90	92	22	133,500	112,140	21,360	50,113,392
April, 1899........	24,175,000	....	1,934,000	90	92	20	117,100	98,364	18,736	47,091,810
May, 1899.........	25,448,500	136,000	1,796,500	90	92	21	123,000	103,320	19,680	49,489,231
June, 1899........	23,694,750	645,500	759,500	90	92	19	126,300	106,092	20,208	42,647,173
July, 1899........	27,756,500	60,000	2,129,000	90	92	21	124,600	104,664	19,936	51,149,637
August, 1899......	27,731,000	1,260,500	....	90	92	21	123,900	104,076	19,824	51,111,291
September, 1899..	24,382,750	244,500	1,555,500	90	92	20	123,100	103,404	19,696	45,422,976
Total.......	291,934,250	4,392,000	15,650,000	90	92	19.7	1,440,000	1,209,690	230,400	45,877,028

Record of fires during the year.

PREPARED BY CHIEF ENGINEER PETER GAUER.

Date.	Time.	Duration.	Pressure at station.	Gallons of water pumped.	No. of box.	Extinguished by chemical or no water used.
1898.		H. M.				
Oct. 25.....	3:15 p m	....	....	....	18	
Nov. 15.....	3:40 a m	....	....	....	41	
Nov. 25.....	1:00 a m	1 45	90–100	24,000	64	
Dec. 8.....	5:35 p m	....	....	....	16	
Dec. 16.....	11:10 a m	....	....	....	61	
Dec. 27.....	2:20 a m	2 25	90–100	40,000	64	
Dec. 30.....	1:00 a m	....	....	....	62	
1899.						
Jan. 6.....	7:45 p m	0 35	90–100	4,000	34	
Jan. 14.....	2:00 p m	1 30	85–100	36,000	43	
Jan. 18.....	7:40 p m	....	....	....	18	
Jan. 22.....	4:00 p m	....	....	....	23	
Jan. 28.....	8:25 p m	0 20	90–100	2,000	41	
Jan. 29.....	4:45 a m	....	....	....	45	
Feb. 4.....	1:45 p m	....	....	....	16	
Feb. 7.....	3:30 p m	....	....	....	31	
Feb. 10.....	3:00 a m	1 30	90–100	24,000	45	
Mar. 3.....	8:50 p m	....	....	....	215	
Mar. 7.....	7:05 a m	0 40	70–100	6,000	51	
Mar. 24.....	3:45 p m	....	....	....	18	
Apr. 1.....	5:30 p m	....	....	....	27	
Apr. 4.....	8:40 a m	....	....	....	53	
Apr. 5.....	11:30 p m	5 00	80–100	206,000	27	
Apr. 8.....	5:45 p m	....	....	....	46	
Apr. 11.....	7:15 p m	....	....	....	42	
Apr. 13.....	4:45 a m	....	....	....	14	
Apr. 17.....	4:50 p m	....	....	....	16	
Apr. 17.....	4:55 p m	0 05	85–90	1,000	31	
App. 18.....	11:10 p m	....	....	....	43	
Apr. 22.....	3:45 p m	....	....	....	41	
Apr. 26.....	12:15 a m	1 05	100–105	18,000	41	
May 11.....	3:50 p m	....	....	....	54	
May 15.....	6:30 p m	....	....	....	45	
May 21.....	8:50 p m	2 15	80–90	39,500	28	
May 28.....	2:37 p m	0 15	90–100	2,000	18	
May 28.....	10:35 p m	8 00	90–105	408,000	45	
June 4.....	3:15 p m	....	....	....	63	
June 26.....	2:50 p m	1 40	76–83	88,000	32	
July 4.....	2:10 p m	0 17	80–82	2,000	16	
July 10.....	2:15 a m	0 25	80–82	6,000	32	
Aug. 13.....	5:35 p m	....	....	....	43	
Aug. 17.....	9:00 p m	0 10	80–90	600	18	
Aug. 22.....	7:20 p m	....	....	....	26	
Aug. 29.....	1:05 p m	....	....	....	34	
Sept. 3.....	11:55 a m	....	....	....	31	
Total	....	....	....	907,100	......	....

RETROSPECT.

Seventeen years of the existence of our water works have now passed by, and the citizens of Madison can well feel proud of the work accomplished.

Year after year proves that the claims and statements we have made are correct in their results.

That the faith of the Common Council of 1881-2 in municipal ownership has been justified, that a municipality can conduct its own water works on a business basis as well as a private corporation. The cost of the works at the end of the fiscal year was $329,400.31. Of this sum $7,000 was donated to the General Fund, $38,544.96 expended for services to curb free to takers, and $41,491.93 expended for water meters free to takers, which no company does.

No aid has been asked from the city since 1896 and the past year $2,000 was turned over from the receipts toward the bond fund, making a sum total of $89,036.89. The gross receipts from the water rents were $259,078.88; operating expenses $160,586.94, giving net receipts of $98,491.94. Cash received for water permits $5,368.00, making a cash total of $103,859.94, leaving a total net receipt of $49,304.18, a gain of 15 per cent. on the investment.

To further show the benefit of municipal ownership will give the comparison. If the city would have given the franchise to the private corporation in 1881, the amount paid to company for hydrant rental to date, would have been $266,975.00; interest at 5 per cent. $13,759.45, a sum total of $280,734.00, only $53,340.77 less than the total cost of construction to the end of this fiscal year by the city. If we deduct the $89,036.89 above mentioned it would leave the city a surplus of $35,696.12, over and above the hydrant rental paid to company. The amount the city would have paid the company the past year for hydrant rental would have been $21,600, whereas the cost of construction was only $6,181.74.

As a matter of record, I will summarize the results achieved during the past seventeen years, giving the expenditures from the outset, with interest paid. The amount of bonds issued April, 1882, for construction, was $76,000 at 5 per cent. These bonds have been paid off gradually down to $8,000. The interest paid on these bonds during these years was $44,300.00. The amount received from the sinking fund under act of legislature, for the construction, was $22,849.50. Amount received from tax levy under amended charter, was $202,899.99, making a grand total of $346,049.49.

There was transferred from the water fund to the sinking fund since 1882, $68,000, reducing the debt to $8,000 — $7,000, was transferred to the general fund in 1889, and the past year we transferred another $2,000 to the bond fund. Total $77,000. The net receipts and permits were $103,859.88, reducing the expenditures down to $242,189.61 against $280,734.00 to private company,

MANAGEMENT.

The citizens of Madison certainly feel indebted to your honorable body for the careful, zealous and efficient management in their grand work carried on and accomplished, knowing full well your willingness to give your time and ability to these arduous duties and responsibilities free to the city, ever ready to guard the trust tendered you sacredly.

CONCLUSION.

Before closing this report of the doings of the department, I wish to express my grateful appreciation to each member of the board for the valuable counsel and assistance rendered me in the discharge of my duties. It shall be my endeavor with your kind assistance, to labor for the continuous success, and increased results, to place the Madison City Water Works amongst the foremost ranks in the country and as a model to be patterned after.

I also desire to express my utmost satisfaction to the secretary, meter inspectors, chief engineer and assistants, firemen and laborers, for the ever ready and faithful discharge of their respective duties, aiding to carry on the work successfully, to obtain the results we have achieved.

Respectfully submitted,

JOHN B. HEIM,
Superintendent.

SUMMARY OF STATISTICS.

Pepulation by census 1895.	15,950
Population estimated by directory	17,884
Date of construction	1881–1882
By whom owned	City of Madison
Source of supply	10 artesian wells
Mode of supply	The water is drawn direct from the wells and up to a distance of 5,010 feet from the station.
1. Pumping machinery	Reynolds-Corliss engines with Knowles pumps combined
2. Description of coal	Anthracite pea
3. Price per ton	$3.50
4. Coal consumed for the year in lbs.	1,440,000
5. Coal consumed for the year in tons	720
6. Total pumpage for the year in gallons	291,934,250
7. Difference between center of pump and gauge	9 feet
8. Average static head against which pumps work	$229\frac{70}{100}$
9. Average dynamic head against which pumps work	$247\frac{70}{100}$
10. Duty in foot pounds per 100 pounds of coal net combustible, making no deduction for starting, banking fires, heating of buildings, or anything else	45,877,028
11. Cost of pumping, figured on operating expenses including care of grounds, per million gallons	$38.10

12. Cost per million gallons raised one foot high (dynamic)	$11\frac{10}{100}$ c
13. Net cost of plant to date	$333,075.22

CONSUMPTION.

1. Estimated population	18,000
2. Estimated population supplied	15,636
3. Total number of gallons pumped	291,934,250
4. Average daily consumption in gallons	799,819
5. Number of takers	2,606
6. Number of meters	2,410
7. Average gallons pumped per day for each taker	307
8. Average gallons pumped per capita	40⅔ or 44½
9. Average pounds of coal consumed per day	3,945
10. Average pounds of coal consumed per year for each taker	552½

DISTRIBUTION.

1. Kind of pipe used for mains	Cast iron
2. Size	From 4 to 16 inches
3. Total miles of mains	$33\frac{1997}{5280}$
4. Total hydrants	164
5. Total valves	228
6. Kind of pipe for services	Extra strong lead
7. Total miles of service pipe (lead)	$13\frac{1002}{5280}$
8. Total feet of cast-iron suction pipe	6,279
9. Total valves connected with suction pipe	17

ANALYSIS OF WATER.

	City water.	Waukesha Bethesda Springs.
Potassium sulphate	0.237	0.454
Sodium sulphate	0.286	0.542
Sodium phosphate	Trace.	Trace.
Bi-carbonate of soda	1.094	1.256
Bi-carbonate of lime	15.224	17.022
Bi-carbonate of magnesia	12.984	12.388
Bi-carbonate of iron	0.214	0.042
Sesqui-oxide of aluminum	Trace.	0.122
Silica	0.414	0.741
Sodium chloride	0.292	1.100
Organic matter	None.	1.983
Total solid contents per gallon	30.745	35.710

INVOICE.

48 feet of 16-inch cast iron pipe.
6 feet of 14-inch cast iron pipe.
20 feet of 12-inch cast iron pipe.
66 feet of 10-inch cast iron pipe.
12 feet of 8-inch cast iron pipe.
170 feet of 6-inch cast iron pipe.
396 feet of 4-inch cast iron pipe.
40 feet of 3-inch cast iron pipe.
2 16x16x8 tee.
1 16-inch cap.
1 12x12x12 tee.
1 8x8x8 tee.
2 4x4x4 tee.
1 8 to 6 reducer.
1 8 to 4 reducer.
1 6-inch curve.
2 6-inch plugs.
1 16-inch sleeve.
2 14-inch sleeves.
3 12-inch sleeves.
1 10-inch sleeve.
4 6-inch sleeves.
4 3-inch sleeves.
4 5-inch hydrants.
6 4-inch hydrants.
4 5-inch hydrant rods with valve attached.
15 4-inch hydrant rods with valve attached.
6 5-inch hydrant gates.
15 4-inch hydrant gates.
1 Nye pump.
1 trench pump.
1 differential block.
3 valve boxes.
42 feet of 9-inch well tubing.
56 sprinkling valves.
1 12-inch hub valve.
14 tampers.
7 coils ⅝-inch extra strong lead pipe.
1 coil ¾-inch extra strong lead pipe.
150 feet ¾-inch hose.
1 furnace and kettle.
24 sewer braces.
1 truck.
1 lawn mower.

1 3-arm sprinkler.
1 6-foot chain tong.
1 2-foot chain tong.
16 5/8-inch corporations.
11 3/4-inch corporations.
2 1-inch corporations.
19 5/8-inch rd. way stops.
8 3/4-inch rd. way stops.
3 1-inch rd. way stops.
2 2-inch rd. way stops.
1 Morse valve reseating machine.
2 21-inch wrenches.
1 16-inch wrench.
1 14-inch wrench.
1 12-inch wrench.
1 10-inch wrench.
1 8-inch wrench.
1 16-inch trimo wrench.
2 14-inch trimo wrenches.
2 18-inch star wrenches.
1 breast drill.
6 lbs. 1/2-inch square duck packing.
5 lbs. 3/8-inch square duck packing.
5 lbs. 1/2-inch rawhide packing.
2 lbs. 3/8-inch rawhide packing.
3 lbs. 7/8-inch piston rod packing.
1 lb. 3/4-inch piston rod packing.
5 lbs. valve rod packing.
6 lbs. 3/8-inch valve rod packing.
29 pump valves.
18 valve springs.
6 square feet 1/2-inch rubber sheeting.
4 yards one ply rubber sheeting.
6 glass gauges.

METERS AND SPECIALS.

25 5/8-inch meters.
16 3/4-inch meters.
2 1-inch meters.
1 2-inch meter.
41 5/8-inch crown covers.
10 3/4-inch crown covers.
10 5/8-inch Hersey covers.
7 5/8-inch Hersey bottoms.
6 3/4-inch Hersey covers.
3 3/4-inch Hersey bottoms.
5 5/8-inch Thomson bottoms.
35 straight reading crown registers.
28 5/8-inch A. A. crown intermediate gears.
6 5/8-inch A. crown intermediate gears.
6 3/4-inch A. crown intermediate gears.
34 5/8-inch Hersey intermediate gears.
10 5/8-inch Thomson intermediate gears.
4 5/8-inch rotary piston, old style crown.
5 3/4-inch rotary piston, old style crown.
8 5/8-inch rotary piston, Hersey.
1 3/4-inch rotary piston, Hersey.
2 5/8-inch rubber rings, Hersey.
5 3/4-inch rubber rings, Hersey.
9 5/8-inch rubber discs, Thompson.
6 3/4-inch rubber discs, Thompson.
1 1-inch Hersey dial.
2 3/4-inch Hersey dials.
1 5/8-inch Crown dial.
1 3/4-inch Crown dial.
1 3/4-inch Nash dial,
2 5/8-inch Thomson dials.
2 5/8-inch Hersey hoods.
5 3/4-inch Hersey hoods.
1 2-inch set top and bottom plates
1 3/4-inch set top and bottom plates.
2 5/8-inch set top and bottom plates.
3 doz. flange bolts, Hersey.
6 doz. flange bolts, Crown.
1 doz. 5/8-inch extension meter service connections.
63 meter boxes.

FIRE ALARMS.

Signals of the fire alarm from bells and whistle are as follows, and is same number of blows as number of box:

SIGNAL BOXES.

Box.	*Location.*
3.	Fuller & Johnson W'ks 3 blows.
12.	Wis. Ave.and Gorham Sts.
14.	State, Gilman and Broom Sts.
16.	Mifflin and Broom Sts.
18.	State and Fairchild Sts.
21.	Washington Av.and Franklin S.
23.	Dickinson and Dayton Sts.
24.	Johnson and Few Sts.
26.	Johnson and Patterson Sts.
27.	Gorham and Butler Sts.
28.	Pinckney, Mifflin and Hamilton Sts.
31.	Pinckney and Doty Sts.
32.	Main and Hancock Sts.
34.	Wilson and Blair Sts.
41.	Main, Carroll and Hamilton Sts.
42.	Mound and Mills Sts.
43.	Wilson and Broom Sts.
45.	West Main St., at C., M. & St. P. tracks.
46.	Drake and Brooks Sts.
51.	University Av. and Lake St.
52.	State and Park Sts.
53.	West Johnson and Park Sts.
54.	University Av. and Charter St.
61.	Main and Blount Sts.
62.	Jenifer and Brearley Sts.
63.	Williamson and Livingston Sts.
64.	Jenifer and Baldwin Sts.
65.	Winnebago St. and Atwood Av. near Elmside.

INSTRUCTIONS FOR OPERATING FIRE-ALARM BOXES.

Key can be had at any one of the nearest houses to the boxes. Unlock the door, pull the hook all the way down and let go. Do not jerk the hook down and up, but pull it down steadily as far as you can. Wait at the box until the department arrives and inform them where the fire is.

The tower bell will strike and the whistle will blow for No.34 – – – – – – – three blows, a short pause, then four blows; after which a long pause. The above will be repeated three additional times. The whistle will give the alarm twice.

Each key is registered. Do not attempt to remove the key; it will be released and returned when the fire is out.

Signals for use of department only are as follows:

Fire out — one tap.

More pressure — two taps.

Second alarm — two taps repeated.

RULES FOR THE WATER METERS.

The following rules have been adopted by the Board of Water Commissioners to govern the use of water meters:

SECTION 1. All services which may hereafter be connected with the City Water Works system, and all services that are still without a water meter, shall be connected with the meter furnished by the city. All meters must be placed by a licensed plumber at expense of property owners, and as near as possible to where service pipe enters building. The plumber doing the work must flush pipe thoroughly before connecting the meter. The city will repair all meters that are clogged, and if lead chips are found to be the cause, a fine of $1 will be collected from the plumber doing the work for each and every job so found, before issuing another permit to said plumber. No water meter shall be removed or disturbed without first having obtained permission from the Superintendent of the Water Works.

SECTION 2. A check and waste shall be placed between the shut-off cock and meter, within one foot of the meter. All meters shall be so located and placed as to afford easy access thereto, and so that they can be easily examined and read. In all cases where meters have been ordered and have been supplied, no water from the City Water Works shall be taken, received or supplied to the building for which the same was constructed and intended, except that which shall pass through and be registered by such meter.

SECTION 3. The consumers of the water supplied through any water meter shall make all necessary repairs; when destroyed by frost, the City of Madison will make all such repairs at cost. A licensed plumber must remove and replace such meter. The expenses of such repair shall be chargeable to such consumers, and shall be paid at the time such repair was made and in case of failure to pay for such repair, the Superintendent of the Water Works shall shut off the flow of water furnished through such meter. No defective meter shall be removed without first having obtained permission from the Superintendent of the Water Works.

SECTION 4. In case that any water meter should fail to register the quantity of water passing through the same, the consumers will be charged at the rate of the average daily consumption registered by such meter the corresponding month of the previous year.

SECTION 5. In all cases where one service connection or yard hydrant does supply two or more separate consumers, premises, tenements, business houses, or a block occupied by divers parties, one meter only will be placed at the service connection of either or all of said consumers, and the water rent as registered by said meter shall be chargeable to and payable by the owner of said premises or buildings. Parties desiring more than one meter must furnish them at their own expense.

SECTION 6. Water rents, where meters have been placed, shall be collected for the first six months and fraction thereof at the schedule rate, as it will require the registration of six months, that is from one rent day to the next, to be able to get the amount to collect. Thereafter as per record of meter the preceding six months, in a manner as prescribed in section 13 of water works ordinance, for each building, premises or consumer. No rebate will be allowed. No water meter rental will be charged by the City of Madison. The rate of water rent to be charged where meters are in use shall be according to the meter rate established by these rules, the minimum whereof being in all cases two dollars and twenty-five cents ($2.25) per six months. Meters will be read monthly.

SECTION 7. The Superintendent of the Water Works system. meter inspectors, or any person employed by the Board of Water Commissioners, shall be given free and ready access to the premises and buildings for the purpose of examining or repairing any meter or connection therewith. Any and all meters shall be left in the condition and manner as set by the city, and shall not be interfered with in any manner whatsoever.

SECTION 8. In case of any violation of any of the foregoing rules and regulations, the water supply furnished to the consumer guilty of such violation shall immediately be shut off, and shall not be resumed except upon a satisfactory adjustment of all the differences connected therewith, and upon the payment of the sum of one dollar for shutting off and turning on the water. Anybody violating any of these rules and regulations shall, upon conviction thereof, be subjected to a fine not to exceed twenty-five dollars ($25), and the cost of prosecution.

METER RATES.

First 5,000 cubic feet or less, per six months, per hundred cubic feet, 20 cents.

Over 5,000 cubic feet and up to 20,000 cubic feet, per six months add $10.00 for first 5,000 cubic feet and 10 cents for each additional 100 cubic feet.

Over 20,000 cubic feet and up to 30,000 cubic feet, per six months, add $25.00 for first 20,000 cubic feet, and 5 cents for each additional 100 cubic feet.

Over 30,000 cubic feet and up to 60,000 cubic feet, per six months, add $30.00 for first 30,000 cubic feet and 3 cents for each additional 100 cubic feet.

Over 60,000 cubic feet and up to 90,000 cubic feet, per six months, add $39.00 for first 60,000 cubic feet and 2 cents for each additional 100 cubic feet.

Over 90,000 cubic feet, per six months, per 100 cubic feet, 5 cents.

Minimum per six months, $2.25.

THAWING FROZEN WATER PIPES BY ELECTRICITY.

JOHN B. HEIM,

SUPERINTENDENT CITY WATER WORKS, MADISON, WIS.

We have passed through the memorable winter of 1899. A winter unprecedented for its severe and extreme cold beyond our recollections. To make it more memorable it endangered the water pipes, which had been laid below the frost line, as taught by previous experience. But as in all extreme cases, the winter brought with it a new discovery. With us at Madison, Wisconsin, the cold weather set in as early as the 24th of November, 1898. The thermometer never registering above the freezing point, and at times, near and below zero, until the 24th of January, when a still colder spell set in, lasting for twenty consecutive days, registering below zero, and for several days it hovered at 26° and 28° below.

The extreme cold brought on a continuous freezing crowding the frost downward, and reached with us in places the depth of six feet.

Our water mains have a covering of five feet and over, which naturally caused alarm and meant mischief. The more so with the service connections as they are of a smaller diameter.

We luckily averted the freezing of our mains by an untiring care and watchfulness both day and night by examining the hydrants, flushing the mains at the extreme ends to replenish the water, and with a continuous flow of water at several extreme points where there are but few takers, with the exception of a single block of a four inch main. This block that froze is 660 feet long with a taker for nearly every 33 feet but with no sewer connections.

These takers draw only a few pails of water a day and there were several dead services. The connections leading to this four inch main froze gradually and in spite of all our flushings, caught the main for about 200 feet.

These different services in contact with the main acted as so many icicles and partitions and froze that part of the main. The hydrant in connection with this main we found in running order on the 13th day of Februaro, and on the 15th of February we found it frozen, the thermometer then registering 40° above. The curious fact was, that at every tap in the main, we found the main cracked both ways from the corporation cock, showing that the services were the cause of the freezing of the main.

We had about 400 services frozen scattered all over the city. Some of these, the takers could dispense with the use of the water, calling upon their neighbors, who had luckily escaped, for their supply. But there were such that depended entirely upon the city water, they had to have water at any cost. They called upon the plumbers to help them out, the city refusing to thaw them out at the expense of the tax-payers and the other takers who had escaped freezing by watching closely and whose plumbing was right. Everything at the command of the plumbers was brought into use, to thaw the services, succeeding as a rule in a couple of days. But there was one service which seemed to baffle all contrivance, the steam tubing would not penetrate the pipe owing to some obstruction. We afterwards found that the plumber who had done the work on the inner side of the curb-stone, had raised the service pipe supplying this house at the curb, so, that after grading had been done for a cement walk, the pipe was covered only one foot and nine inches under the walk and then it must have been laid waving both ways, so as to prevent the steam tubing to make any progress whatsoever. Professor R. W. Wood, A. B., instructor in physics at the University of Wisconsin, resides near by. He noticed the difficulty in passing there daily. This set him to thinking that electricity might perhaps solve the problem. The lead pipe being a metal conductor, the electric current would naturally follow the pipe.

He at once consulted Professor Dugald C. Jackson, C. E., professor of Electrical Engineering of the University of Wisconsin, who agreed with him on the method. The two men then set about computing how much of a current would be needed, how not to injure the pipe by heat, how much of electricity would escape into the ground, how the current could be obtained from the Electric Company, how its volume might be controlled, etc.

After a plan of precedure had been conceived, arrangements were made with the Electric Company to meet them next morning with the necessary apparatus at this house to make a trial. Professor Wood spent the morning in preparation and as soon as Professor Jackson could break away from his class he joined him, when every computation calculated upon was made and every detail perfected. The one wire connection was made inside of the house wound around the service pipe where it entered the building. The other wire was wound around the pipe at the curb where it had been severed by the plumber for the steam tubing, then the current was turned on. I had hold of the pipe in the house while the current was passing through the pipe. The effect on the pipe was sufficiently noticeable to show that the chill had been taken off, it was only about 60 degrees.

Imagine our expectation! Would this theory be practical? Would it be a success? When to our joy the water began to trickle.

We then attached a hose to the corporation at the main with the severed pipe at the curb, turned on the water, when lo! and behold we found the pipe was free from ice. This pipe was about forty feet long. With this success, a start was made for another service of over 150 feet long. Same procedure in connecting wire was made with this service as with the first trial; 250 amperes equivalent to 15 H. P. with a voltage of 50 was used, and in exactly 12 minutes the water began to run.

Another trial was then made by connections at an outside faucet used for sprinkling of the one house and on the inner side of another house across the street, a distance of 300 feet apart with the same success.

Then again another trial was made by connecting the wire with the pipe inside of the house with the meter attached, to the hydrant across the street, connecting by clamping the wire to the valve-stem rod. Success was met in every instance. Professors Jackson and Wood at once magnanimously turned over their discovery, invention and method to the world, ready to give to the people the benefit of the results of their study, labor and success.

Then the Electric Company proceeded forthwith to prepare the necessary apparatus and commenced to thaw out services all over the city. Where convenient, two services were thawed out at the same time.

The glorious news spread; it was carried abroad. The suffering seemed universal and here was relief unexpectedly. Science gained an additional lustre. The University of Wisconsin had moved one step further in the advancement of progression in electricity.

Every mail brought inquiries, soliciting information, printed instructions had to be resorted to.

President C. K. Adams, LL. D., of the University of Wisconsin, at once issued a circular, giving full information, regarding the process, which contained also a sketch, showing the method of using the alternating current for thawing and offered to send competent men from the institution to aid in putting the device in operation, charging only the actual expenses incurred by these men.

At least fifty cities in Wisconsin and immediately contiguous states, called for information and some for assistance. Where assistance was called for the senior electrical students were sent.

Watertown, Wis., was the first city that called for aid. Both Professors Jackson and Wood took this matter in hand personally, it being the first opportunity to try it on a water main. Three hundred and twenty feet of a six-inch main was thawed out in two and a half hours, using two 25-Kilowat transformers. The wires were connected in parallel with two hydrants a block apart, delivering a current of 100 volts. No water resistance was used as the resistance of the main was sufficient to prevent overloading the transformer. They only got about 350 amperes. Had they

been able to get 800 amperes, it would have taken only thirty minutes. The calculated computation worked successfully wherever the current could be had, as, for instance, Appleton, Beloit, Fort Atkinson, Fond du Lac, Iron River, Janesville, Kaukauna, La Crosse, Madison, Manitowoc, Milwaukee, Oconto, Portage, Phillips, Reedsburg, Sheboygan, Stoughton, all of Wisconsin; Rockford, Illinois; Ann Arbor, Bay City, Iron Mountain, Marquette and Saginaw, Michigan; Mankato, Faribault and Rochester, Minnesota; Ithaca, New York; Great Falls, Montana; Sturgis, South Dakota, and many other cities which reported their results. At Marshfield, Wis., they were unable to get more than 250 amperes; it took between five and six hours to thaw out a six-inch main. We had inquiries from New York, Pennsylvania, New Jersey, Illinois, Indiana, Michigan, Iowa, Missouri, Kentucky, Alabama, Colorado, Montana and South Dakota, in fact from all over the states. Wherever heard from, where the method was used and instructions followed, success was met with. In several instances where no attention was paid to the right computation, they found harmful effects of using too much current, causing the lead pipe to melt as also the brass connections.

Superintendent L. E. Kerns of the Electrical Company of our city, says: "We used the alternating current 1,000 volts primary, reducing through transformers to fifty volts and at this pressure using from 200 to 325 amperes. The services that had no flaws in them or where unbroken required an average of about fifteen minutes each to thaw them out. Those that were broken or contained flaws required from thirty minutes to three hours to thaw them. We thawed 101 services at a cost of $5.55 per service. The size of wire that we used was No. 2, B. & S. Gauge."

Superintendent W. M. Kimball of Rockford, Illinois, Water Works, says: "The electrical thawing was a great success. We thawed out 126 services; the best results we obtained was, when we could get from 250 to 300 amperes. In thawing out these services several blocks of frozen mains were also thawed out. The time required to thaw a service depended upon its length, the degree it was frozen, the amperage of the current, etc., and varied from ten minutes to two hours and thirty minutes. The cost was at the rate of $4.80 per service actually thawed, including all labor, line men, team work, etc."

Supt. E. A. Croll of Iron Mountain, Michigan, Water Works, says: "We have been very successful in thawing service pipes from ½ inch to 2 inch, and found the time varied from 6 minutes to one hour and 20 minutes according to the length, and we have thawed every pipe we have tackled. On services the longest ¾ inch iron 340 feet took 30 minutes using 250 amperes at 52 volts. The light plant furnished us current at 1,000 volts primary, which we transformed to 52 volts. We thawed 900 feet 2 inch wrought iron pipe in sections of 300 feet, with

250 amperes at 52 volts, the last 300 feet included 160 feet of 6 inch cast iron pipe in 2½ hours."

I could enumerate many more cities giving their results, but with the above and the information received through the engineering, electrical and water works journals, let this suffice.

This thawing process has proved itself a grand discovery and a boon to both managers of water works plants and their patrons.

The public is greatly indebted to both Professors Jackson and Wood for this timely discovery and generous gift. There is no more tearing up of streets in winter and with its probable endangering of the mains; no more danger of destroying the hydrant valves by steam; and the cost of the thawing out is brought within reach of everyone.

As soon as it became known that success had been met by the electric thawing process, others wanted the credit. They at once claimed the right of "I knew it first; we used it long ago." If such was the case, why did they keep their discovery so quiet, that it never was heard of outside of their city? Why did they let their fellow citizens suffer? We should always give credit to whom credit is due, and not endeavor to wrench the laurels from the victor's brow. If we thought electricity could be used, but made no effort to bring it into use, we deserve no credit.

I will now give you the computations Professor Jackson was kind enough to give me for further information that have been verified in the different cities where the conditions were proper and the thawing successful.

To thaw out lead or iron services up to 1½ inch you should use from 200 to 250 amperes; if you are not able to get more than 125 amperes it will take four times as long. If you use over 250 amperes you are liable to get into trouble by overheating the corporation cock, stop cock, and all other brass connections.

Wrought iron pipe must be watched very closely so that the joints do not heat; it has lower resistance, higher conductivity, requiring more current, in order to make more heat, therefore you must watch the unions, that is where the heat occurs.

It is necessary to use a source of current which does not affect the electric light lines or other transmission lines, if current is taken from them, danger may result. We have therefore ordinarily used a transformer in the work, but in some cases have used dynamos directly. The source of current should have a pressure of not less than 50 volts. To thaw out 500 feet of a 6 inch main in half an hour requires 800 amperes, if you are unable to get more than 400 amperes it will take four times as long, or two hours; 800 amperes will thaw out 500 feet of a 12 inch main in one hour and a 24 inch main in two hours, etc. The source of current for water mains should have a pressure of not less than 200 volts.

The illustration herewith given shows the connection for thawing out two frozen service pipes by joining wires to the inside faucet of the one house, and to the outside faucet of the neighboring house. In preparing to thaw out a water main, connect with two hydrants, wind the wire around the hose nozzle. (See illustration.) Screw hydrant nozzle cap up to the wire, making a close connection, commence at open end, where there is no frost, with 800 amperes or less and 200 volts, and thaw say 50 feet at a time. Water should be kept running for at least an hour after main has been thawed as it will take that length of time before water will be slightly warmer; $\frac{3}{4}$ H. P. will thaw a 6 inch main in half an hour per foot length; $\frac{2}{10}$ H. P. will thaw a one inch and an $\frac{1}{8}$ H. P. will thaw a $\frac{5}{8}$ service pipe in half an hour per foot length. There is no danger from electrolysis on account of the short duration of the thawing process and the ground being frozen.

Herewith are the directions for thawing service pipes up to one and a half inches in diameter which are prepared and sent out by the University of Wisconsin, when and where solicited.

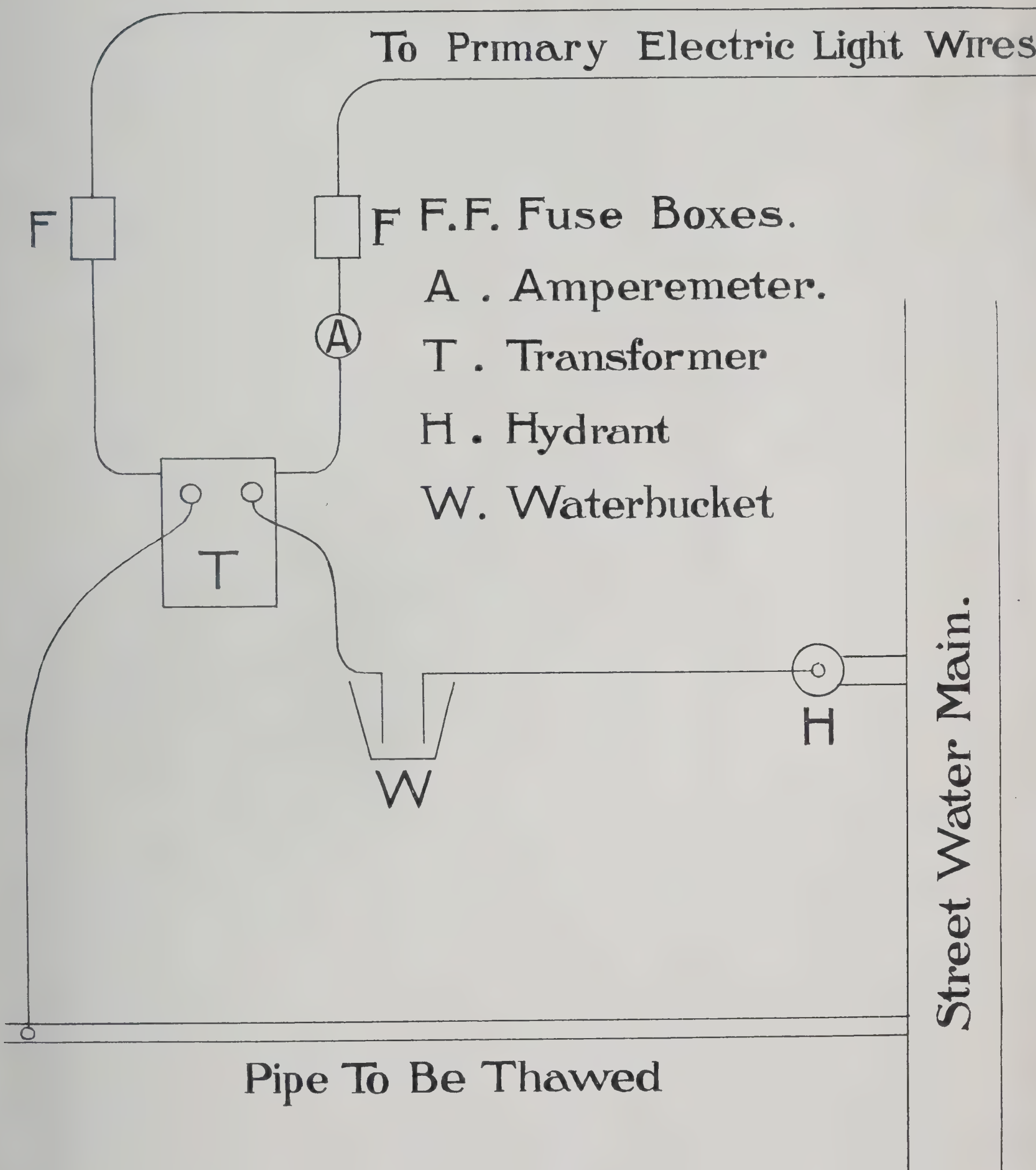
"The current which is required for thawing service pipe satisfactorily is from 200 to 300 amperes. The source of current should have a pressure of not less than 50 volts. Where electric light lines carrying alternating currents are available, a transformer or transformers in parallel may be used as a source of current. It is very important that direct connection of pipes to house lines be avoided on account of danger of fire in which the house is placed by such connection.

Where alternating currents are not available continuous current feeder lines may be used, but these should be entirely separated from the distributing net work of conductors.

The illustration will show the way in which the appliances should be connected when an alternating current is used with transformer. The secondary leads from the transformer should be quite large, such as No. 3 B. & S. gauge, or larger. In making connection to the pipes, one of the secondary leads should be taken into the house to which the frozen service pipe leads and contact made at that point by some form of metallic clamp or by simply giving the conductor two or three tight twists about the pipe at any point where the pipe is exposed or at a faucet in the house. The other secondary lead should be put in contact with the water system outside of the house and in a similar manner. This contact may be made at a hydrant or at any adjoining service box, or pipes in a neighboring house. When there are two houses near together, each with frozen service pipes, the two secondary leads may be connected to the pipes within these houses and both frozen service pipes thawed out at once.

While the thawing process is going on, the faucet should be open in the house to which the service pipe leads. In one of the secondary

THAWING FROZEN WATER PIPES BY ELECTRICITY.


To Primary Electric Light Wires
F
F
F.F. Fuse Boxes.
A . Amperemeter.
T . Transformer
H . Hydrant
W. Waterbucket
A
T
W
H
Street Water Main.
Pipe To Be Thawed

leads should be inserted a water resistance which consists for convenience, of a bucket of water containing a bowlful of salt, and two sheet-iron or copper plates to which the ends of the severed lead are attached. This serves to control the current. In the primary leads from the electric light line to the transformer it is highly desirable to have a fuse in each lead, and an amperemeter. When all connections are made, the plates are placed in the bucket and are then moved towards each other until the amperemeter records a proper current. If the primary pressure is 1,000 volts and the secondary pressure 50 volts, the current should ordinarily approach 15 amperes. If the primary pressure is 2,000 volts and the secondary pressure 50 volts, the amperemeter reading should ordinarily approach 7.5 amperes.

Water ordinarily begins to flow in a time not much less than 10 minutes or not greater than an hour. If the secondary current is quite close to 300 amperes the period seldom exceeds one-half hour. The frozen pipes are often split by the action of the frozen water and these at once begin to leak when the ice is thawed away. For this reason it is desirable to have a plumber where he may be readily called to care for the leaky pipe.

The electric current when properly used will not damage the pipes. It is desirable to watch brass and iron connections to lead or iron service pipes, as they sometimes heat on account of poor contact. If such heating appears to be excessive, the current may be reduced with a resulting increase in the duration of time for thawing.

After the pipe has been thawed it is desirable to let the water run continuously for a considerable length of time, inasmuch as the ground all around the pipe is frozen and the pipe is liable to freeze up again unless the water circulates.

In closing this paper let me give you an extract from an insurance paper as to the financial result of this discovery: "A slight estimate of the value of the invention of thawing out frozen pipes by electricity to underwriters can be found from the fact that in 1898, insurance companies paid out nearly $300,000 in losses caused by primitive methods of thawing out pipes."

MAP OF THE
WATER WORKS SYSTEM
OF
MADISON
WISCONSIN.
JOHN B. HEIM Supt.
EXPLANATION:
PROJECTED LINES IN RED
PRESSURE AT HYDRANT IN RED FIGURES
SUCTION PIPE IN RED
LAKE MENDOTA
LAKE MONONA
LAKE WINGRA
UNIVERSITY GROUNDS
BROOKS ADDITION
UNIVERSITY ADDITION
BOWEN'S ADDITION
GREENBUSH ADDITION
WINGRA PARK
OAKLAND HEIGHTS
WARRENS ADDITION
SOUTH MADISON
BADGER ADDITION
ORTON PARK
1st Wd.
2nd Wd.
3rd Wd.
4th Wd.
5th Wd.
6th Wd.
7th Wd.
8th Wd.
CHICAGO AND NORTH-WESTERN
CHICAGO, MILWAUKEE & ST. PAUL
CHICAGO MADISON & NORTHERN
STATE CAPITOL
WASHINGTON AVE
SCALE
10 Chains to an Inch.

EIGHTEENTH

ANNUAL REPORT

OF THE

CITY WATER WORKS

OF

MADISON, WISCONSIN

1900

Compliments of

John B. Heim

Superintendent.

WATER WORKS PUMPING STATION.

EIGHTEENTH ANNUAL REPORT

OF THE

Board of Water Commissioners

OF THE

CITY OF MADISON

For the Year Ending September 30, 1900

TOGETHER WITH THE

REPORTS OF THE SUPERINTENDENT AND SECRETARY

MADISON
STATE JOURNAL PRINTING COMPANY
1901

LIST OF WATER COMMISSIONERS[1]

Under whose charge the Water Works was placed, and time served.

COMMISSIONERS

*James Conklin..1884–5–6–7–8–9
*H. Christoffers..............................1884–5–6–7–8–9–90–1–2–3–4
R. M. Bashford[2]..1884–5–6
John Lamont[3]...............................1886–7–8–9–90–1–2–3
A. Donovan.. 1889–90–1–2
John R. Melvin...............................1892–3–4–5–6–7–8–9
W. W. Warner..1893–4–5–6
J. J. Silbernagel............................... 1894–5–6–7–8–9
J. Van Etta..1896–7–8–9

EX-OFFICIO

*H. N. Moulton,[4] Mayor....1885–6
A. Donovan, Alderman.....1885–6

E. W. Keyes, Mayor.......1886–7
M. J. Cantwell, Alderman..1886–7

*James Conklin, Mayor.....1887–8
G. J. Corscot, Alderman....1887–8

M. R. Doyon, Mayor.......1888–9
S. G. Oakey, Alderman.....1888–9

M. R. Doyon, Mayor......1889–90
E. L. Baker,[5] Alderman...1889–90
F. C. Sheasby,[6] Alderman..1889–90

R. M. Bashford, Mayor.....1890–1
H. Schulkamp, Alderman ..1890–1

W. H. Rogers, Mayor 1891–2–3
H. Schulkamp, Ald'man..1891–2–3

John Corscot, Mayor.......1893–4
R. F. Taylor, Alderman.....1893–4

John Corscot, Mayor.......1894–5
W. C. Noe, Alderman......1894–5

Jabe Alford, Mayor 1895–6
W. H. Lansing, Alderman..1895–6

A. A. Dye, Mayor..........1896–7
Ed. Quammen, Alderman...1896–7

M. J. Hoven, Mayor........1897–8
Ed. Quammen, Alderman...1897–8

Chas. E. Whelan, Mayor ...1898–9
Ed. Quammen, Alderman ..1898–9

M. J. Hoven, Mayor 1899–1900
Ed. Quammen, Ald'man.1899–1900

M. J. Hoven, Mayor 1900–1
Ed. Quammen, Alderman...1900–1

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[1] First commissioners elected April 15, 1884.

[2] Resigned March 1, 1886.

[3] Elected to fill vacancy.

[4] Mayor and alderman ex-officio added to board April, 1885.

[5] Resigned.

[6] Elected to fill vacancy.

* Deceased.

OFFICERS OF THE WATER WORKS

JOHN R. MELVIN, PRESIDENT . . .	Term expires October 1, 1901
J. J. SILBERNAGEL	Term expires October 1, 1903
J. VAN ETTA	Term expires October 1, 1902
M. J. HOVEN	Mayor, *ex-officio*
EDWARD QUAMMEN	Alderman, *ex-officio*

O. S. NORSMAN, SECRETARY

SUPERINTENDENT

JOHN B. HEIM

METER INSPECTORS

NICHOLAS REIF
FRANK T. HAYES

ENGINEERS

PETER GAUER
DENNIS DACEY
AUSTIN GANNON

FIREMEN

JOHN LYONS
PATRICK DORIS

WATER WORKS OFFICE

CITY HALL, SECOND FLOOR

Regular meetings of the board Wednesday previous to common council meeting of each month at 3 o'clock P. M.

All bills against the department must be rendered on or before the 28th of each month, or they will lie over until the following regular meeting.

Water rents are due and payable, in advance, at the office of the City Treasurer on the first days of January and July of each year.

CITY ORDINANCE

"*All water rents shall be paid semi-annually the first days of January and July of each year in advance; any water rents, whether by schedule or meter*, which shall not be paid within thirty days after the same become due and payable, shall be increased by a penalty of ten per cent., and if the same shall not be paid, together with the penalty thereto attached, within ten days after the same become due and payable, the water shall be shut off from the consumer so in default."

REPORT OF THE COMMISSIONERS.

OFFICE OF THE BOARD OF WATER COMMISSIONERS,
CITY OF MADISON, WIS.,
February 6, 1901.

To the Honorable Mayor and Common Council:

We have the honor to submit herewith our eighteenth annual report covering the operations of the water works department during the year ending on the 30th day of September, 1900.

The most important action taken by this board during the past year was that of making provision for new pumping machinery, and the erection of an addition to the pumping station which was found necessary in order to properly house the new pumps. By and with the consent of your honorable body a contract was entered into with the E. P. Allis Co., of Milwaukee, Wis., for such new pumping machinery, the contract price being $21,400. The contract for the addition to the building was awarded to T. C. McCarthy at $5,757 for the complete work.

The receipts of the department show a gradual and gratifying increase, being $26,610.39 as against $23,879.50 the previous year. The total expenses were $20,879.28 as compared with $20,209.21 the year before.

The Superintendent's report gives a detailed account of the past year's work, together with recommendations on matters to be considered during the current year, and we respectfully ask your careful consideration thereof.

All of which is respectfully submitted,

J. R. MELVIN,
J. J. SILBERNAGEL,
J. VAN ETTA,
M. J. HOVEN,
ED. QUAMMEN,
Commissioners.

SECRETARY'S STATEMENT

Of receipts and expenditures of the water department of the city of Madison for the year ending September 30, 1900:

RECEIPTS.

Balance on hand October 1, 1899	$6,553 94	
Water rents collected	25,853 39	
Water permits collected	316 00	
Plumber's licenses	10 00	
Miscellaneous receipts	431 00	
		$33,164 33

EXPENDITURES.

Construction expenses	$7,959 82	
Operating expenses	11,784 36	
Repair expenses	1,135 10	
Transferred to bond fund	5,000 00	
Water rents refunded	51 13	
Balance on hand September 30, 1900	7,233 92	
		$33,164 33

MISCELLANEOUS.

Total receipts from water rents to October, 1, 1900	$284,932 21
Total receipts, water permits	5,684 00
Total operating expenses to October 1, 1900	172,371 30
Total construction and extensions	337,360 13
Total cost of repairs	11,390 94
Cost of new boilers put in 1897	3,675 00
Amount of bonds issued for construction of plant	76,000 00
Amount of this issue now outstanding	8,000 00
Water works extension bonds issued in 1893	10,000 00
Total water bonds now outstanding	18,000 00

Respectfully submitted,

O. S. NORSMAN,

Secretary.

SUPERINTENDENT'S REPORT.

MADISON, WIS., February 6, 1901.

To the Honorable, the Board of Water Commissioners:

GENTLEMEN: — In compliance with the city ordinance I herewith present to you the eighteenth annual report of the water department, showing the work of the department and its financial condition for the year ending September 30, 1900.

FINANCIAL.

The financial condition of the department for the past year is not only gratifying, but is more favorable than that of the previous year.

We not only have paid all expenses without assistance from the city, but have also placed $5,000 of the earnings of the department into the bond fund for the payment of the bonded debt of the department.

The net receipts for the year were $33,164.33; this includes the cash balance on hand September 30, 1899, of $6,553.94.

The total expenditures for operating, new mains, service connections, water meters and repairs were $20,930.41. This with the $5,000 transferred to the sinking fund made a total of $25,930.41, leaving a cash balance in the water fund September 30, 1900, of $7,233.92.

The net earnings from water rents over and above the operating expenses, including the interest on the bonds the past year, was $13,219,03.

The total cost of the water works plant to year ending September 30, 1900, was $337,360.13.

The net receipts from all sources, including permits, since construction are $104,178.97. This leaves the total cost of construction, less net receipts, the sum of $233,181.16, a net

earning of 22¼ per cent. on the investment. Deducting the $45,150 of interest paid on the bonded indebtedness since construction, gives the net earnings 17 per cent.

The total present indebtedness is $18,000. This is made up of $10,000 bearing interest at 4½ per cent., and $8,000 at 5 per cent., making a total of $850 annual interest.

On the first day of April, 1901, $6,000 of the bonded indebtedness will be paid, thus reducing the indebtedness to $12,000 and the interest to $550 per annum.

This rare showing of a municipal plant places the water department of the city of Madison, Wisconsin, alongside of the foremost of the country.

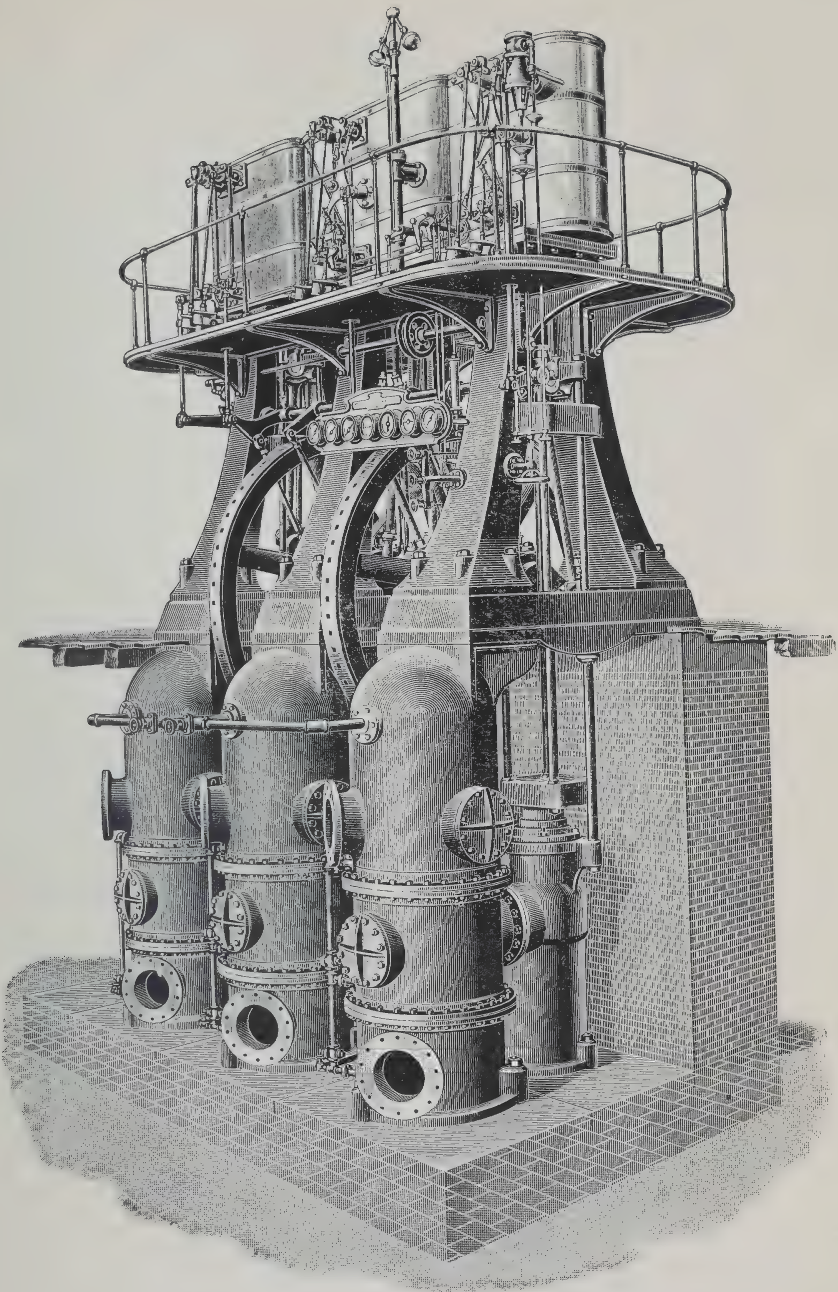
NEW PUMPS.

Your honorable body seeing the wisdom of our recommendation in our last annual report for new pumping machinery, after due deliberation and investigation, contracted with the Edward P. Allis Company of Milwaukee, Wis., for a three million gallon Reynolds triple expansion pumping engine, at a cost of $21,400.

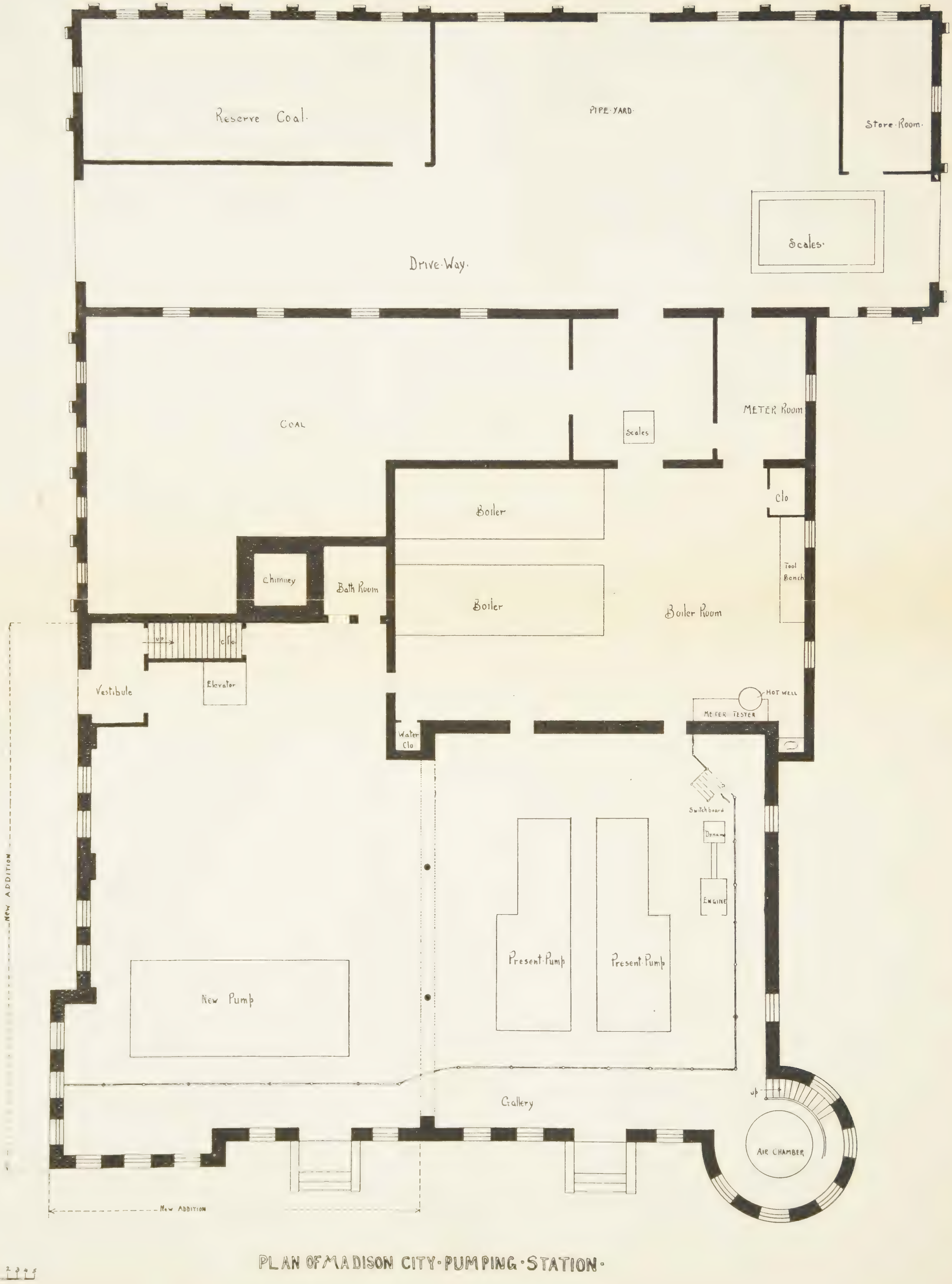
It is to be of the most modern improved type, the best of its kind in America, and will be the pride of the city of Madison. The installation of this machinery will probably be completed in May. Annexed is a cut of the pumping engine as it will appear when in place. Necessary appliances will be attached so that the students of the University of Wisconsin in the engineering course may make tests when required in their work.

ADDITIONAL BUILDING.

The foundations for the new pumping engine are 17 feet deep. This is 10½ feet lower than the present pumping engines, the object being to get nearer to the water, and to meet the suction main laid in 1895. It was necessary that we have a new building for the new machinery by reason of the fact that the pumping station is located on an old lake bed, with a running sand, which give rise to the possibility



THE NEW THREE MILLION GALLON REYNOLDS TRIPLE EXPANSION PUMPING ENGINE.



PLAN OF MADISON CITY·PUMPING·STATION·

Scale

of the pumps tearing away from the connections of the suction and discharge mains, thereby cutting off the supply of water from the city.

An addition 38 x 60 was planned by Architects Gordon & Paunack of this city, to conform and be part of the present building. With this addition it will be one large engine room of 3,892 square feet. The contract for this addition and including the foundation for the new pumps was awarded to T. C. McCarthy of Madison, Wis., for the sum of $5,757, he being the lowest bidder. Annexed is the ground plan of the pumping station, including the new addition.

NEW SUCTION.

A new 16-inch suction main was laid last fall and connected with the suction on the southeast side of the present building, at a depth of 11 feet. The necessary branches to connect the four artesian wells on the grounds were also laid, so as to connect with these wells in early spring for the testing of the machinery before acceptance.

ELECTROLYSIS.

The action of the electric currents of the trolley system of the Electric Light and Power Company affects and injures our service pipes. This is particularly so near the power house, where we were obliged to replace the services, the lead pipe being gradually destroyed. Our cast iron main has not suffered as in other cities, probably on account of the nature of the soil.

I would recommend that a thorough investigation and examination of the water mains and services be made the present year to ascertain the effect of these currents, and to adopt safeguards to prevent, if possible, further damage.

It would be well to ask the common council to adopt an ordinance, as other cities have done, compelling the Electric Light & Power Company to place its electric system in such a condition that no further damage be done to underground pipes.

DEAD SERVICES.

During the past few years we have laid 17,046 feet of lead service connections (which means 456 taps) previous to the macadamizing of streets, where streets had been ordered by the common council to be macadamized, to prevent the tearing up of streets when a call for water is made.

This, we find, is not a good investment. Instead of preventing the tearing up of streets, it has the contrary effect. Most of our leaks the past year were from dead services, caused by water hammer. This is caused by the fact that there is no relief at the curb. It being a dead end, with the direct pressure continuously crowding, it finally breaks the pipes. This not only tears up the street, but undermines the same. Another destroyer of these services is the frost. All our services are laid 6½ feet deep, but with a winter like 1898 every such service will freeze on account of its inactivity, and it will shorten the life of the pipe. Another objection to these services is this: When we lay these services we consult the owner of the property as to the probable location of buildings to be erected. The property changes hands, and the new owner divides the lot on a different plan from the previous owner; the service connection is then out of place, and a new service has to be laid at the expense of the city. The service already laid remains dead capital. This has happened, as you are aware, at different times. The past year we laid services that we are satisfied will not be connected with for years to come, and probably not until after the street requires repairing. This is a useless expense. The cost of these dead services during these few years was $8,693.46. Of these only a few have been connected with. As a rule these services are mostly for vacant lots. This is too much dead capital lying idle, with a continuous expense connected therewith.

I would recommend that these service connections be dispensed with, except in cases where there are buildings

already erected, or likely to be within a year. I feel as much pride in our streets as our most particular citizen, and felt that the proper course had been pursued in the laying of these services, but past experience has taught us otherwise.

FIRE HYDRANTS.

I must again call your attention to the misuse of the hydrants by the street sprinklers. Your honorable body caused sprinkling valves to be attached to the hydrants, but still the abuse continues; not with the hydrant so much, but with the valve. The street sprinklers should be compelled to place their carts in the hands of responsible parties. Time and again we have been obliged to replace the valve stems, or regrind the valve seat or face, because either the valve stem was turned the wrong way or crowded too hard, thereby creating a nuisance by continuous leaking.

Again, the city seems to delegate the right to the use of the fire-hydrants to any novice or contractor doing work for the city in macadamizing streets and building cement gutters. This is contrary to the ordinance.

In several instances the past years, when we flushed the mains, we found hydrants out of working order unknown to the department. In case of a fire, these hydrants could not have been used, and might have resulted in great injury.

The hydrants ought to be treated sacredly; *they are for fire protection only.* Some day a fire may occur in the vicinity of a dead hydrant and a large conflagration may result from this abuse of the hydrant.

WATER METERS.

During the past year we increased our meters from 2410 to 2586, an increase of 176. Of these, 152 were for new and 24 for old takers; this still leaves 135 takers without meters.

We will gradually connect those remaining as fast as they are connected with the sewer system.

The total amount expended for meters of all sizes (the city furnishing the meters free to the consumers, including the meter-boxes), *and the placing of the meters free at the introduction of the meter system by the water department in 1888–89*, up to September 30, 1900, was $43,039.64, an average of $16.64⅓ per meter.

The past year we consumed, having 2,758 takers, 1,441,600 pounds, or 720 4-5 tons, of coal (which is only 1,600 pounds more than in 1899–1900, with 152 additional takers), an average of 522⅗ pounds for each taker. In 1884–85, with only 699 water-takers, without meters, we consumed 1,210,150 pounds, or 605 tons, of coal, being 1,731 pounds for each taker, a difference of 1,208 pounds. This means a saving the past year, calculating at same pumpage as in 1884–85 (with no sewer system), with 2,059 more takers, at $4.39 per ton of coal (contract price for the past year), of $7,314.83. Adding this amount to the $38,132.16 saved since 1888 under the meter system amounts to $45,407.35; deducting the cost of the meters as above, leaves a surplus of $2,407.35 over and above the cost of the meters.

What would have been the result if we had remained under the schedule rate system is difficult to conjecture.

The pumpage in 1884–85 for each taker per day was 781 gallons of water against 303⅗ gallons the past year. That would mean an average of 2,154,791 gallons per day against only 837,332 gallons pumped in 1899–1900. This is more significant when we remember that we now have the additional burden incident to a sewer system, street sprinkling and water-motors.

The all-absorbing conundrum these many years would have been *more water*, and at a *great expense*, which we happily solved through the meter system. Besides, the saving in fuel the past twelve years, since the adoption of the meter system, has covered the cost of the meters.

The total amount of water that passed through the meters the past year was 111,744,573 gallons, for which the city received $23,069.51.

The per capita for these 2,586 takers connected with meters, calculating on six to a taker, which includes manufacturing establishments, with large forces of men, hotels and boarding-houses, amounts to 19 3-4 gallons per day. Calculating the per capita of the 172 consumers under the schedule rate at six members, and the ratio at 50 gallons per day, it would mean 18,834,000 gallons for the year. For extinguishing of fires we pumped 349,400 gallons of water. The free water for the year we estimate at 155,328,000 gallons, which would leave 20,381,477 gallons for flushing of mains, leaks and laying of new mains.

The per capita for all water pumped was 43 2-3 gallons per day. Ten hundred and forty-eight water-takers paid only the minimum water-rate of $2.25 at the January payment, and 1,158 paid the minimum of $2.25 at the July rent-day.

The meter repairs for the past year, exclusive of those broken by frost, for which the consumers pay, was $68,25.

The following table shows the number of meters in use for each year since October, 1884, the amount of water pumped, coal consumed, population and the per capita, based on all water pumped:

Year.	Population.	No. of takers.	No. of meters.	Gallons water per year.	Gallons water per day.	Pounds coal per year.	Pounds coal per day.	Gall'ns per capita.
1884-85	11,325	699	3	199,333,840	546,120	1,210,150	3,315	48
1885-86	12,063	876	5	236,649,850	648,355	1,339,900	3,671	53
1886-87	12,063	980	5	261,308,160	715,885	1,124,200	3,123	59
1887-88	12,063	1,099	210	257,682,300	704,050	1,047,200	2,861	58
1888-89	12,063	1,229	385	195,450,770	535,480	914,500	2,540	44
1889-90	12,063	1,355	441	190,810,910	520,030	1,331,500	3,648	43
	Census 1890							
1890-91	13,246	1,405	498	197,889,450	542,162	1,044,000	2,860	38
1891-92	13,246	1,554	547	236,035,800	646,753	1,173,100	3,214	47
1892-93	13,246	1,701	673	268,246,300	734,921	1,302,200	3,567	50
1893-94	13,246	1,820	795	272,006,950	745,224	1,3[illegible]3,800	3,819	48
	Census 1895							
1894-95	15,950	1,994	1,223	313,705,500	859,467	1,514,400	4,152	53
	School census.							
1895-96	17,884	2,186	1,726	325,408,500	891,530	1,558,000	4,268	50
1896-97	17,884	2,334	2,071	290.972,750	797,186	1,470,600	4,029	45
1897-98	17,884	2,473	2,269	273,016,500	750,730	1,470,200	4,028	41½
1898-99	17,884	2,606	2,410	291,934,250	799,819	1,440,000	3,945	40⅔ 41¼
	Census 1900							
1899-00	19,164	2,758	2,586	306,639,450	837,338	1,441,600	3,950	43⅔

The following table shows the number, size and kind of meters in use October 1, 1899:

Kind.	$\frac{5}{8}$ in.	$\frac{3}{4}$ in.	1 in.	$1\frac{1}{2}$ in.	2 in.	3 in.
Crown	1,867	68	15	1	2	....
Hersey	224	128	4	......	2	....
Thomson	115	....	......	......	......	....
Westinghouse	28	....	......	......	......	....
Union	20	....	......	......	......	....
Nash	2	2	......	......	......	....
Trident	105	....	......	......	......	....
Worthington	....	2	......	......	......	1
	2,361	200	19	1	4	1

COMPARISON.

The all-absorbing topic of late years amongst water-works managers has been whether it was not better to conduct a water system under a schedule rate in preference to collecting by meters. The inference is that the income was less under the meter system where water was a second consideration, being drawn from lakes and rivers, or received by gravity from hills and mountains.

This led me to investigate the matter, using our city with a general meter system as a comparison. We have a direct pressure system, drawing our water from artesian wells, and are compelled to use hard coal on account of the surroundings. The elevation of portions of the city necessitates 90 pounds domestic pressure. My comparison was made with leading cities of high standing, with several minor cities, and with one Wisconsin city, La Crosse, which has no meters. La Crosse showed the largest wastage of water. It was in fact considerable larger than Chicago, which has only 3 1-4 per cent. of its taps metered.

I asked this information from the officials of the cities below enumerated, so as to be sure to have the *bona fide* facts, and have filed the answers in the water office for perusal in case of doubt.

The information asked for was the population (census of 1900), pumpage, fuel, number of takers and meters in use, receipts and disbursements, and whether a minimum rate was used or not.

The receipts from water rents and operating expenses I was obliged to omit in my summary, on account of the vast difference in the water rates, in the fuel and its cost. But I give the average collected per taker, including the meter rents where collected. The vast difference in the pumpage plainly shows that the meter system is the true system of a water works plant.

If we compare La Crosse, Wis., which is under the schedule rate entirely, with our city with 94 per cent. of our taps metered, they having only 353 takers more than we, and are obliged to pump 2,034,663,450 gallons against our 306,637,450 gallons of water during the year. This is over 6½ times as much water as we pumped, collecting only $5,961.19 more for the year that we did for the additional 1,728,026,110 gallons of water pumped.

This ought to convince the strongest opponent that the meter system is the only system when we consider the fuel and machinery it requires to pump this amount of water.

Again La Crosse collected in water rents under the schedule rate for 2,034,663,560 gallons of water pumped, the sum of $31,814.58, which means $15.60 per million gallons. Cost of operating was $22,874.98 or $11.20 per million gallons, earnings, $4.40.

Our city collected in water rents, under the meter system, $25,853.39 for 306,637,450 gallons, which means $84.30 per million. Cost of operating with the necessary assistance required under the meter system and the use of hard coal at $4.39 per ton was $11,784.36 or $38.40 per million gallons, a net earning of $45.90 against $4.40 by the city of La Crosse.

The result of the comparison was a very gratifying surprise to us, substantiating all claims that we have hereto-

fore made. I expected that some of the cities would have a smaller pumpage per capita than our city, but the result proves that we lead.

Of course large manufacturing cities enter into this comparison, but with a pumpage of 155,328,000 gallons of free water for our city, this comparison will have to stand.

I have tabulated the answers received for easy comparison in the order of gallons pumped daily per capita, beginning with the smallest amount, also giving the kind of fuel used in each city, the meter rates, and the amount collected per taker per annum, to bear out my statement in reference to the receipts and operating expenses.

The result also proves that a scale meter rate and a minimum water rate are essential, and that where they have a flat rate and no minimum water rate, as in the case of Milwaukee, the general fund must come to the rescue of the water fund.

For the authenticity of this comparison I give the names of the officials that gave the information. I am satisfied that this comparison will be very interesting and a source of gratification to your honorable body and to our citizens, as it proves that the general meter system is the best and most remunerative.

I am greatly indebted to the officials for the kind and prompt information and courtesies extended.

WATER PERMITS.

During the year we issued 152 original water permits as against 133 the previous year, making total number of takers September 30, 1900, 2,758. Calculating on an average of six takers on the census of 1900, would mean that there are only 436 families without the city water. Most of these families live across the Yahara river and in Greenbush addition, where there are no water mains.

City.	Population, Census 1900.	Water System.	Domestic Pressure in lbs.	Number of Water takers.	Number of Meters in Use.	Per cent. metered.	Kind of Fuel Used.	Total number Gallons of Water Pumped in 1900.	Daily Average.	Daily Average Gallons per Taker.	Daily Average Gallons per Capita.	Meter Rate, Gallons.	Meter Rent.	Schedule Minimum Rate Per Annum	Meter Minimum Rate Per Annum.	Average Water Rent Collected per taker per Annum.	Name of Official
Madison, Wis........	19,164	Direct pressure.	90	2,758	2,586	94	Anthracite pea	306,637,450	837,332	303⅔	43⅔	5 to 20c per 100 c. f.	None	$5 00	$4 50	$9 37	John B. Heim
Atlanta, Ga..........	125,000	Direct pressure.	60	10,000	9,000	90	Steam coal	2,146,635,750	5,881,194	588	47	10c per M. for Manf'rs	60c per month	7 20	7 20	7 50	Park Woodward
Newport, Ky	30,000	Reservoir.	80	5,020	468	9	Bituminous	533,000,000	1,460,274	291	48⅔	15c per 100	Not given	4 00	....	9 68	Geo. Hornung
St. Paul, Minn.......	164,000	Gravity and reservoir.	10 to 80	17,093	4,812	28	Youghiogheny coal	2,927,293,331	8,009,982	468⅔	49	25c per 100	15c to $2.40 per month according to size	3 00	3 00	11 04⅔	John Caulfield
Battle Creek, Mich...	18,500	Standpipe.	60 to 85	2,419	1,878	76	Powells run coal	372,000,000	1,019,178	421¼	55	7-13c per M.	15 per cent. on cost of meter per annum	4 00	4 00	8 51	W. W. Brigden
Glasgow, Scotland ...	1,017,000	Gravitation.	20 to 100	250,000	1,165	10½	None	20,787,480,000	56,952,000	227⅘	56	3⅗ d. per M.	5 per cent. on cost of meter per annum	5*d* per £ on ground value of premises	£2 or $10 00	4 04	J. R. Sutherland
Providence, R. I	175,597	Reservoir.	30 to 80	21,566	17,813	82½	Hard and soft coal	3,867,644,483	10,588,067	491	56½	Not given	Not given	6 00	10 00	25 73	Robert E. Smith
Toronto, Canada.....	220,000	Direct pressure.	40 to 80	38,000	1,700	4½	Soft coal screenings	7,000,000,000	19,178,219	504½	64	6½ to 25 per M.	$4 to $5 per annum according to size	5 00	5 00	8 68	C. H. Stone
Montreal, Canada....	300,000	Direct pressure.	30 to 75	57,500	1,165	2	Nova Scotia steam coal	7,450,365,317	20,420,179	355⅓	68	15 to 30 per M.	$3 to $10 per annum according to size	5 00	5 00	13 82	Geo. Janin
Elgin, Ill	22,433	Standpipe.	60	2,825	160	5⅔	Illinois	632,606,110	1,733,167	613½	77¼	4 to 20c per M.	Not given	4 00	10 00	10 09	R. R. Parkin
Milwaukee, Wis	285,315	Standpipe and direct.	25 to 55	41,485	28,000	67	Youghiogheny screenings	8,625,626,050	23,631,852	569½	82¾	4½ per 100	Meter owned by consumer	*	*	8 47	Chas. J. Poetsch
Rockford, Ill	31,051	Direct pressure.	55	3,373	270	8	Washed nut soft coal	948,113,610	2,597,571	770	83⅔	8 to 20 per 100	None	5 00	6 00	11 66½	W. M. Kimball
Reading, Pa	78,961	Gravity and reservoir.	30 to 125	15,885	636	4	Anthracite and bituminous	2,620,850,000	7,180,411	452	91½	$2\frac{2}{10}$ to 30 per 100 c. f.	None	4 50	4 50	7 50	E. L. Neubling
Minneapolis, Minn...	202,718	Gravity and reservoir.	75	19,000	5,030	26	Sawdust	6,863,135,200	18,803,110	989⅔	92¼	8c per 1,000	Not given	2 00	4 00	11 15	F. T. Moody
Newark, N. J........	250,000	Gravitation.	30 to 75	33,000	10,077	30½	None	8,791,000,000	24,084,932	730	96⅓	5 to 15 per M.	None	7 00	9 00	16 62	M. R. Sherrerd
Syracuse, N. J	108,374	Gravity and reservoir.	95	17,075	8,037	41	None	4,013,175,000	10,995,000	644	101½	3½ to 14 per 100	Not given	5 00	5 00	13 88	John H. Moffitt
Richmond, Va.......	100,000	Reservoir.	20 to 70	12,000	4,621	38½	Water	3,996,889,795	10 950,383	912½	109	5 to 15 per M.	Not given	4 00	4 00	12 24	Chas. E. Bolling
Harrisburg, Pa.......	57,000	Standpipe and reservoir.	40 to 80	12,500	4,278	34	Hard white ash pea coal	2,993,928,100	8,202,542	656	144	10c 100 c. f. 2¼ to 8 per M.	Not given	5 00	5 00	8 51	Edmund Mather
Grand Rapids, Mich .	90,000	Reservoir and direct.	30 to 90	8,910	1,293	14½	Coal	5,013,665,672	13,693,499	1538	152	Not given	None	5 00	5 00	13 54	B. Meyer
Chicago, Ill..........	2,000,000	Standpipe.	20	200,000	6,500	3¼	Anthracite and bituminous	117,887,260,024	322,978,794	1699	161½	4 to 10 per M.	None. Meter repaired at expense of consumer	7 00	7 00	4 04	A. O. Nourse
La Crosse, Wis	28,900	Direct pressure.	60	3,111	none	....	Coal	2,034,663,560	5,574,420	1792	193	....	....	5 00	....	10 22⅔	W. A. Anderson

* $76,000.00 from the general fund was placed into the water fund, to meet expenses on account of flat rate and no minimum.

WATER RENTS.

The annual revenue from the 2,758 water takers was $25,853.39 ($2,461.27 more than the previous year), from permits $316, a total of $26,169.39, an average of a trifle over $9.37 for each taker.

OPERATING EXPENSES.

The operating expenses for the year ending September 30, 1900, were $11,784.36, $662.03 more than in 1899–1900, on account of the additional price per ton of coal of 89 cents over the previous year.

The consumption of coal for the past year was only 1,600 pounds over the previous year with 152 additional takers, which means 508 pounds of coal for each taker, against 553 pounds in 1898–99.

Conklin & Sons furnished the anthracite pea coal for the year at $4.39 per ton, they being the lowest bidders.

The net receipts from water rents over and above the operating expenses the past year were $14,069.03, and this was placed in the construction and repair fund.

The average cost of operation for each water taker was 4.08\frac{1}{3}$.

CONSTRUCTION EXPENSES.

The expense of construction, extensions, service connections and meters for the year was only $7,959.82.

REPAIRS.

The repairs during the year amounted to $1,135.10, and for the past eighteen years the average has been $695.89 per year.

SERVICE CONNECTIONS.

During the past year we laid 4,007 feet of lead services, which brings the number of feet of extra strong lead service pipe laid to curbstone to 73,429 feet, or 13$\frac{5009}{5280}$ miles of pipe. We also laid 991 feet of lead services to the curbstone, wher-

ever possible before the streets were macadamized, to prevent tearing up of streets when called for.

Thus far we have laid 17,046 feet of lead services to curb, which are not included in the summing up of the actual services in use.

These 17,046 feet mean 456 taps to be connected with when applications are made for water.

The following tables show on what streets service pipes were laid the past year, for new takers and those ready for connection when called for, giving size, number of feet on each street or avenue, and the total.

Table showing services laid for new takers.

Streets and Avenues.	$\frac{5}{8}$ in.	$\frac{3}{4}$ in.	1 in.	$1\frac{1}{2}$ in	2 in.	Total.
Baldwin street	77	....	....	....	....	77
Bassett street	96	....	....	....	....	96
Blair street	19	....	....	....	....	19
Brooks street	19	....	....	....	....	19
Broom street	48	....	....	....	....	48
Bruen street	19	....	....	....	....	19
Butler street	116	....	....	....	....	116
Carroll street	29	13	....	....	....	42
Chandler street	72	....	....	....	....	72
Charter street	19	....	....	....	....	19
Clymer street	58	....	....	....	....	58
Dayton street	423	19	....	....	....	442
Dickinson street	67	....	....	....	....	67
Doty street	......	29	....	....	....	29
Franklin street	182	....	....	....	....	182
Few street	19	....	....	....	....	19
Francis street	29	....	....	....	....	29
Gilman street	57	....	....	....	....	57
Gorham street	144	....	....	....	....	144
Hamilton street	77	....	....	....	....	77
Hancock street	77	....	....	....	....	77
Henry street	57	....	....	....	....	57
Ingersoll street	19	....	....	....	....	19
Jenifer street	133	....	....	....	....	133
Johnson street	240	....	....	....	....	240
King street	29	....	....	....	....	29
Main street	67	19	....	....	9	95
Marion street	19	....	....	....	....	19
Mifflin street	183	....	29	....	....	212
Mills street	38	....	....	....	....	38
Murray street	48	....	....	....	....	48
Park street	48	....	19	....	....	67
Patterson street	19	....	....	....	....	19
Pinckney street	31	29	19	....	....	79
Rutledge street	19	....	....	....	....	19
Sherman avenue	96	....	....	....	....	96
State street	......	19	....	19	....	38
University avenue	81	....	....	....	....	81
Warren street	19	....	....	....	....	19
Washington avenue	288	....	....	....	....	288
Webster street	116	....	....	....	....	116
Williamson street	231	....	....	....	....	231
Wilson street	209	29	....	....	....	238
Wisconsin avenue	128	....	....	....	....	128
Total	3,755	157	67	19	9	4,007

Table showing services laid to curbstone beford macadamizing of streets to prevent tearing up for connections hereafter.

Streets.	Number of taps.	Size, $\frac{5}{8}$ inch.	Size, $\frac{3}{4}$ inch.	Number of feet.
Doty street	7	144	29	173
Johnson street	33	818	....	818
Total	40	962	29	991

NEW MAINS.

During the past year we laid 5,043 feet of 4-inch cast-iron pipe, and 180 feet of 16-inch suction main on pumping station grounds for new pumps; placed 5 hydrants and 6 valves.

The following table shows the extensions made during the year, giving size laid, number of feet, and where hydrants and valves were placed:

Streets.	Cast Iron Pipe.		Hydrants.	Valves.
	4 inch.	6 inch.		
N. Baldwin street	1,348	....	1 4-inch	1 4-inch
Chandler street	1,445	....	3 4-inch	2 4-inch
E Dayton street	660	....	....	1 4-inch
S. Few street	330	....	....	1 4-inch
Mendota Court	330	....	....	1 4-inch
N. Pinckney street	930	....	1 4-inch	....
Pumping station	....	180	....	....
Total	5,043	180	5	6

The cast-iron main laid in Mendota Court took the place of the lead main which was removed.

Would recommend that the lead main on North Paterson and Monona streets be also replaced with a cast-iron main. We are continually repairing these lead mains.

PUMPAGE RECORD.

Monthly record of the amount of water pumped and coal consumed during the year.

(Prepared by Chief Engineer Peter Gauer.)

Months.	Gallons of water pumped.	Revolution of large engine.	Revolution of small engine.	Average steam pressure.	Average water pressure.	Average vacuum.	Pounds of coal consumed.	Net combustibles.	Ashes.	Duties in foot lbs. per 100 lbs. net combustibles.
October, 1899	24,925,000	....	1,994,000	90	90	19	114,300	96,012	18,288	49,543,463
November, 1899	23,458,200	331,000	1,292,500	90	90	18	111,900	93,996	17,904	47,291,076
December, 1899	24,580,750	646,000	829,500	90	90	19	125,800	105,672	20,128	42,351,000
January, 1900	25,787,500	....	2,063,000	90	90	20	121,000	101,640	19,360	48,615,962
February, 1900	23,713,000	504,000	1,010,000	90	90	18	117,900	99,036	18,864	42,139,360
March, 1900	23,750,000	....	1,900,000	90	90	18	111,500	93,660	17,840	47,907,620
April, 1900	24,727,000	466,000	1,130,500	90	90	19	115,800	97,272	18,528	47,116,979
May, 1900	27,830,000	1,265,000	....	90	90	21	133,500	112,140	21,360	44,320,584
June, 1900	29,528,500	740,500	1,059,000	90	90	21	141,600	118,944	22,656	47,283,252
July, 1900	24,325,000	....	1,946,000	90	90	19	108,600	91,224	17,376	51,070,746
August, 1900	28,437,500	....	2,195,000	90	90	21	119,100	100,044	19,056	54,421,137
September, 1900	25,575,000	910,000	446,000	90	90	20	120,600	101,404	19,296	48,299,839
Total	306,637,450	4,862,000	15,865,500	90	90	$19\frac{5}{12}$	1,441,600	1,210,950	230,650	47,530,135

Record of fires during the year.

(Prepared by Chief Engineer Peter Gauer.)

Date.	Time.	Duration.	Gallons of water pumped.	Pressure at station.	No. of box.	Extinguished by chemical or no water used.
Oct. 6, 1899	5:50 p m	....	....	....	26	....
Oct. 16	7:45 p m	....	....	....	16	....
Oct. 19	3:10 a m	0:45	14,000	85–90	14	....
Oct. 27	1:02 p m	....	....	....	45	....
Nov. 4	1:55 p m	....	....	....	42	....
Nov. 9	5:40 a m	0:40	1,000	85–90	27	....
Nov. 12	4:45 p m	....	....	....	26	....
Nov. 30	12:15 a m	....	....	....	54	....
Dec. 6	12:15 p m	....	....	....	14	....
Dec. 25	5:40 a m	....	....	....	32	....
Dec. 26	6:45 a m	....	....	....	21	....
Jan. 4, 1900	5:42 p m	....	....	....	42	....
Jan. 5	9:03 a m	....	....	....	16	....
Jan. 8	12:30 p m	....	....	....	12	....
Jan. 9	1:25 p m	....	....	....	45	....
Jan. 10	7:25 p m	1:05	24,000	80–90	52	....
Jan. 18	5:25 p m	....	....	....	45	....
Jan. 21	6:03 p m	....	....	....	52	....
Jan. 25	7:30 a m	0:50	8,000	85–90	45	....
Jan. 30	7:30 p m	0:20	10,000	80–83	45	....
Jan. 31	9:30 a m	....	....	....	27	....
Feb. 5	1:57 a m	....	....	....	64	....
Feb. 11	5:45 p m	1:35	22,500	80–85	26	....
Feb. 17	11:50 p m	1:05	18,000	83–100	63	....
Feb. 23	3:05 a m	....	....	....	51	....
Feb. 23	3:40 p m	....	....	....	26	....
Feb. 25	2:05 p m	0:35	2,000	85–110	28	....
Mar. 2	12:10 a m	....	....	....	51	....
Mar. 3	3:15 p m	....	....	....	51	....
Mar. 10	11:55 a m	0:25	3,000	85–90	45	....
Mar. 15	10:20 a m	....	....	....	28	....
Apr. 19	10:20 a m	....	....	....	28	....
Apr. 19	2:10 p m	2:25	124,400	60–125	27	....
Apr. 19	7:00 p m	1:00	23,500	80–95	63	....
May 5	3:00 a m	1:25	56,000	90–105	45	....
May 5	12:55 p m	....	....	....	26	....
May 7	5:40 p m	0:20	3,000	90–100	51	....
May 7	6:10 p m	0:15	500	90–100	14	....
May 8	9:25 p m	0:40	7,000	90–100	63	....
May 13	8:48 a m	....	....	....	45	....
May 28	4:17 p m	....	....	....	32	....
May 29	2:45 p m	....	....	....	24	....
June 17	5:45 a m	0:30	8,000	85–100	61	....
July 8	3:45 a m	0:30	2,000	90–95	12	....
Aug. 3	5:45 p m	....	....	....	34	....
Aug. 10	8:25 p m	2:40	56,000	85–100	45	....
Aug. 20	2:00 p m	....	....	....	64	....
Aug. 30	1:18 a m	2:45	16,500	80–85	26	....
Sept. 3	7:30 p m	....	....	....	32	....
Sept. 13	12:05 p m	....	....	....	45	....
Sept. 14	8:05 a m	....	....	....	45	....
Sept. 27	9:05 a m	....	....	....	43	....
Total	....	....	349,400	....	....	Extinguished ....

RETROSPECT.

Our eighteenth year has now passed into history. It ranks alongside of the past years as one of the most prosperous and busiest we have had. The water department has kept even pace with the growth of the city, and when the 40,000 mark is reached, our present artesian wells will be adequate to furnish abundance of water. With the meter system we are able to give this assurance. We now have a total mileage of $34\frac{1760}{5280}$ of water mains, 169 hydrants, 234 valves, 5,915 feet of suction mains, 1,234 feet of lead mains, $13\frac{5009}{5280}$ miles of extra-strong lead service connections and 2,586 water-meters in service. Eighty-six and one-third per cent. of our citizens use the city water. Our plant has cost us to date $337,360.13; deducting from this sum the net receipt from water rents and permits over and above the operating expenses, repairs and new boilers, it reduces the cost of construction from $337,360.13 down to $234,151.16.

MANAGEMENT.

Such a magnificent showing will certainly bring the highest encomium to your honorable body from our citizens for your careful watchfulness and efficient management in the discharge of the duties delegated to you by the common council.

The citizens of Madison can well feel proud of the work that has been accomplished by the water department, in all its phases, and the standing allotted the Madison city water works amongst the foremost systems of the country.

CONCLUSION.

In closing this annual report, I desire to take this occasion to express my gratitude to each member of the board for the ready assistance and valuable counsel rendered me in the discharge of my duties.

It shall be my endeavor, as in the past, to continue to perform the duties intrusted to me in an impartial and

business-like manner, to merit your approbation and that of our citizens.

I also desire to express my thanks to the secretary of the board, the meter inspectors, the chief engineer and assistants, firemen and laborers, for their prompt, willing and faithful efforts in the discharge of their duties, their aim being coincident with the management for the success and prosperity of the Madison city water works.

Respectfully submitted,

JOHN B. HEIM,

Superintendent.

SUMMARY OF STATISTICS.

Population by census 1900	19,164
Date of construction	1881–1882
By whom owned	City of Madison
Source of supply	10 artesian wells
Mode of supply	The water is drawn direct from the wells and up to a distance of 5,010 feet from the station.
1. Pumping machinery	Reynolds–Corliss engines with Knowles pumps combined
2. Description of coal	Anthracite pea
3. Price per ton	\$4.39
4. Coal consumed for the year in lbs.	1,441,600
5. Coal consumed for the year in tons	721
6. Total pumpage for the year in gallons	306,637,454
7. Difference between center of pump and gauge	9 feet
8. Average static head against which pumps work	$223\frac{8}{10}$
9. Average dynamic head against which pumps work	$242\frac{4}{10}$
10. Duty in foot pounds per 100 pounds of coal net combustible, making no deduction for starting, banking fires, heating of buildings, or anything else	47,530,839
11. Cost of pumping, figured on operating expenses, including care of grounds, per million gallons	\$38.43
12. Cost per million gallons raised one foot high (dynamic)	$15\frac{88}{100}$
13. Net cost of plant to date	\$337,360.13

CONSUMPTION.

1. Population 19,164
2. Estimated population supplied 16,548
3. Total number of gallons pumped 306,637,450
4. Average daily consumption in gallons 837,332
5. Number of takers 2,758
6. Number of meters 2,586
7. Average gallons pumped per day for each taker $303\frac{2}{3}$
8. Average gallons pumped per capita $43\frac{2}{3}$
9. Average pounds of coal consumed per day 3,949
10. Average pounds of coal consumed per year for each taker $522\frac{1}{3}$

DISTRIBUTION.

1. Kind of pipe used for mains Cast iron
2. Size From 4 to 16 inches
3. Total miles of mains $34\frac{1760}{5280}$
4. Total hydrants 169
5. Total valves 234
6. Kind of pipe for services Extra strong lead
7. Total miles of service pipe (lead) $13\frac{5009}{5280}$
8. Total feet of cast-iron suction pipe 6,279
9. Total valves connected with suction pipe 17

ANALYSIS OF WATER.

	City water.	Waukesha Bethesda Springs.
Potassium sulphate	0.237	0.454
Sodium sulphate	0.286	0.542
Sodium phosphate	Trace.	Trace.
Bi-carbonate of soda	1.094	1.256
Bi-carbonate of lime	15.224	17.022
Bi-carbonate of magnesia	12.984	12.388
Bi-carbonate of iron	0.214	0.042
Sesqui-oxide of aluminum	Trace.	0.122
Silica	0.414	0.741
Sodium chloride	0.292	1.100
Organic matter	None.	1.983
Total solid contents per gallon	30.745	35.710

INVOICE.

48 feet of 16-inch cast iron pipe.
6 feet of 14-inch cast iron pipe.
20 feet of 12-inch cast iron pipe.
66 feet of 10-inch cast iron pipe.
12 feet of 8-inch cast iron pipe.
170 feet of 6-inch cast iron pipe.
812 feet of 4-inch cast iron pipe.
40 feet of 3-inch cast iron pipe.
1 16x16x8 tee.
1 16-inch cap.
1 8x8x8 tee.
4 4x4x4 tees.
2 4-inch crosses.
1 8 to 6 reducer.
1 8 to 4 reducer.
1 6-inch curve.
2 6-inch plugs.
1 16-inch sleeve.
2 14-inch sleeves.
3 12-inch sleeves.
1 10-inch sleeve.
2 6-inch sleeves.
2 4-inch sleeves.
4 3-inch sleeves.
1 5-inch hydrant.
6 4-inch hydrants.
5 5-inch hydrant rods with valve attached.
14 4-inch hydrant rods with valve attached.
5 5-inch hydrant gates.
5 4-inch hydrant gates.
15 4-inch hydrant sockets.
4 5-inch hydrant sockets.
1 Nye pump.
1 trench pump.
1 differential block.
2 valve boxes.
42 feet of 9-inch well tubing.
56 sprinkling valves.
1 12-inch hub valve.
12 tampers.
11 coils $\frac{5}{8}$-inch extra strong lead pipe.
1 coil $\frac{3}{4}$-inch extra strong lead pipe-
150 feet $\frac{3}{4}$-inch hose.
1 furnace and kettle.
24 sewer braces.
1 truck.
1 lawn mower.
1 3-arm sprinkler.
1 6-foot chain tong.
1 2-foot chain tong.

1 1-inch corporation.
8 $\frac{5}{8}$-inch rd. way stop.
1 1-inch rd. way stop.
1 2-inch rd. way stop.
1 Morse valve reseating machine,
2 21-inch wrenches.
1 16-inch wrench.
1 14-inch wrench.
1 12-inch wrench.
1 10-inch wrench.
1 8-inch wrench.
1 22-inch trimo wrench.
1 16-inch trimo wrench.
2 14-inch trimo wrenches.
1 10-inch trimo wrench.
1 8-inch trimo wrench.
2 18-inch star wrenches.
1 breast drill.
4 lbs. $\frac{1}{2}$-inch square duck packing.
2 lbs. $\frac{3}{8}$-inch square duck packing.
2 lbs. $\frac{1}{2}$-inch rawhide packing.
5 lbs. $\frac{3}{8}$-inch rawhide packing.
1 lb. $\frac{7}{8}$-inch piston rod packing.
1 lb. $\frac{3}{4}$-inch piston rod packing.
3 lbs. valve rod packing.
2 lbs. $\frac{3}{8}$-inch valve rod packing.
22 pump valves.
18 valve springs.
6 square feet $\frac{1}{8}$-inch rubber sheeting.
2 yards one ply rubber sheeting.
2 glass gauges.

METERS AND SPECIALS.

10 $\frac{5}{8}$-inch meters.
2 $\frac{3}{4}$-inch meters.
1 1-inch meter.
1 2-inch meter.
23 $\frac{5}{8}$-inch crown covers.
10 $\frac{3}{4}$-inch crown covers.
2 1-inch crown covers.
9 $\frac{5}{8}$-inch Hersey covers.
2 $\frac{5}{8}$-inch Hersey bottoms.
6 $\frac{3}{4}$-inch Hersey covers.
3 $\frac{3}{4}$-inch Hersey bottoms.
4 $\frac{5}{8}$-inch Thomson bottoms.
28 straight reading crown registers.
24 $\frac{5}{8}$-inch A. A. crown intermediate gears.
4 $\frac{5}{8}$-inch A. crown intermediate gears.
9 $\frac{3}{4}$-inch A. crown intermediate gears.
17 $\frac{5}{8}$-inch Hersey intermediate gears.
9 $\frac{5}{8}$-inch Thomson intermediate gears.
4 $\frac{5}{8}$-inch rotary piston, old style crown.
5 $\frac{3}{4}$-inch rotary piston, old style crown.
8 $\frac{5}{8}$-inch rotary piston, Hersey.
1 $\frac{3}{4}$-inch rotary piston, Hersey.
2 $\frac{5}{8}$-inch rubber rings, Hersey.
5 $\frac{3}{4}$-inch rubber rings, Hersey.
9 $\frac{5}{8}$-inch rubber discs, Thomson.
6 $\frac{3}{4}$-inch rubber discs, Thomson.
1 1-inch Hersey dial.
2 $\frac{3}{4}$-inch Hersey dials.
1 $\frac{5}{8}$-inch Crown dial.
1 $\frac{3}{4}$-inch Crown dial.
1 $\frac{3}{4}$-inch Nash dial.
2 $\frac{5}{8}$-inch Thomson dials.
2 $\frac{5}{8}$-inch Hersey hoods.
3 $\frac{3}{4}$-inch Hersey hoods.
1 2-inch set top and bottom plates.
1 $\frac{3}{4}$-inch set top and bottom plates.
3 $\frac{5}{8}$-inch set top and bottom plates.
3 doz. flange bolts, Hersey.
6 doz. flange bolts, Crown.
1 doz. $\frac{5}{8}$-inch extension meter service connections.
8 meter boxes.
12 meter boxes.

FIRE ALARMS.

Signals of the fire alarm from bells and whistle are as follows, and is same number of blows as number of box:

SIGNAL BOXES.

Box.	Location.
3	Fuller & Johnson W'ks, 3 blows.
12	Wis. Ave. and Gorham St.
14	State, Gilman and Broom Sts.
16	Mifflin and Broom Sts.
18	State and Fairchild Sts.
21	Washington Ave. and Franklin St.
23	Dickinson and Dayton Sts.
24	Johnson and Few Sts.
25	Blount and Gorham Sts.
26	Johnson and Patterson Sts.
27	Gorham and Butler Sts.
28	Pinckney, Mifflin and Hamilton Sts.
31	Pinckney and Doty Sts.
32	Main and Hancock Sts.
34	Wilson and Blair Sts.
41	Main, Carroll and Hamilton Sts.
42	Mound and Mills Sts.
43	Wilson and Broom Sts.
45	West Main St., at C., M. & St. P. tracks.
46	Drake and Brooks Sts.
51	University Ave. and Lake St.
52	State and Park Sts.
53	West Johnson and Park Sts.
54	University Ave. and Charter St.
56	Francis and Langdon Sts.
61	Main and Blount Sts.
62	Jenifer and Brearley Sts.
63	Williamson and Livingston Sts.
64	Jenifer and Baldwin Sts.
65	Winnebago St. and Atwood Ave., near Elmside.

INSTRUCTIONS FOR OPERATING FIRE-ALARM BOXES.

Key can be had at any one of the nearest houses to the boxes. Unlock the door, pull the hook all the way down and let go. Do not jerk the hook down and up, but pull it down steadily as far as you can. Wait at the box until the department arrives and inform them where the fire is.

The tower bell will strike and the whistle will blow for No. 34 --- ----, three blows, a short pause, then four blows, after which a long pause. The above will be repeated three additional times. The whistle will give the alarm twice.

Each key is registered. Do not attempt to remove the key; it will be released and returned when the fire is out.

Signals for use of the department only are as follows:

Fire out — one tap.

More pressure — two taps.

Second alarm — two taps repeated.

RULES FOR THE WATER METERS.

The following rules have been adopted by the Board of Water Commissioners to govern the use of water meters:

SECTION 1. All services which may hereafter be connected with the City Water Works system, and all services that are still without a water meter, shall be connected with the meter furnished by the city. All meters must be placed by a licensed plumber at expense of property owners, and as near as possible to where service pipe enters building. The plumber doing the work must flush pipe thoroughly before connecting the meter. The city will repair all meters that are clogged, and if lead chips are found to be the cause, a fine of $1 will be collected from the plumber doing the work for each and every job so found, before issuing another permit to said plumber. No water meter shall be removed or disturbed without first having obtained permission from the Superintendent of the Water Works.

SEC. 2. A check and waste shall be placed between the shut-off cock and meter, within one foot of the meter. All meters shall be so located and placed as to afford easy access thereto, and so that they can be easily examined and read. In all cases where meters have been ordered and have been supplied, no water from the City Water Works shall be taken, received or supplied to the building for which the same was constructed and intended, except that which shall pass through and be registered by such meter.

SEC. 3. The consumers of the water supplied through any water meter shall make all necessary repairs; when destroyed by frost, the City of Madison will make all such repairs at cost. A licensed plumber must remove and replace such meter. The expenses of such repair shall be chargeable to such consumers, and shall be paid at the time such repair was made, and in case of failure to pay for such repair, the Superintendent of the Water Works shall shut off the flow of water furnished through such meter. No defective meter shall be removed without first having obtained permission from the Superintendent of the Water Works.

SEC. 4. In case that any water meter should fail to register the quantity of water passing through the same, the consumer will be charged at the rate of the average daily consumption registered by such meter the corresponding month of the previous year.

SEC. 5. In all cases where one service connection or yard hydrant does supply two or more separate consumers, premises, tenements, business houses, or a block occupied by divers parties, one meter only will be placed at the service connection of either or all of said consumers, and the water rent as

registered by said meter shall be chargeable to and payable by the owner of said premises or buildings. Parties desiring more than one meter must furnish them at their own expense.

SEC. 6. Water rents, where meters have been placed, shall be collected for the first six months and fraction thereof at the schedule rate, as it will require the registration of six months, that is, from one rent day to the next, to be able to get the amount to collect. Thereafter as per record of meter the preceding six months in a manner as prescribed in section 13 of water works ordinance, for each building, premises or consumer. No rebate will be allowed. No water meter rental will be charged by the city of Madison. The rate of water rent to be charged where meters are in use shall be according to the meter rate established by these rules, the minimum whereof being in all cases two dollars and twenty-five cents ($2.25) per six months. Meters will be read monthly.

SEC. 7. The Superintendent of the Water Works system, meter inspectors, or any person employed by the Board of Water Commissioners, shall be given free and ready access to the premises and buildings for the purpose of examining or repairing any meter or connection therewith. Any and all meters shall be left in the condition and manner as set by the city, and shall not be interfered with in any manner whatsoever.

SEC. 8. In case of any violation of any of the foregoing rules and regulations, the water supply furnished to the consumer guilty of such violation shall immediately be shut off, and shall be resumed except upon a satisfactory adjustment of all the differences connected therewith, and upon the payment of the sum of one dollar for shutting off and turning on the water. Anybody violating any of these rules and regulations shall, upon conviction thereof, be subjected to a fine not to exceed twenty-five dollars ($25), and the cost of prosecution.

METER RATES.

First 5,000 cubic feet or less, per six months, per hundred cubic feet, 20 cents.

Over 5,000 cubic feet and up to 20,000 cubic feet, per six months, add $10.00 for first 5,000 cubic feet and 10 cents for each additional 100 cubic feet.

Over 20,000 cubic feet and up to 30,000 cubic feet, per six months, add $25.00 for first 20,000 cubic feet and 5 cents for each additional 100 cubic feet.

Over 30,000 cubic feet and up to 60,000 cubic feet, per six months, add $30.00 for first 30,000 cubic feet and 3 cents for each additional 100 cubic feet.

Over 60,000 cubic feet and up to 90,000 cubic feet, per six months, add $39.00 for first 60,000 cubic feet and 2 cents for each additional 100 cubic feet.

Over 90,000 cubic feet, per six months, per 100 cubic feet, 5 cents.

Minimum, per six months, $2.25.

ARTESIAN WATER SUPPLY OF THE CITY OF MADISON, WISCONSIN.

BY JOHN B. HEIM, SUPT. CITY WATER WORKS.

I intended to refrain from presenting a paper at this session, as one appearing too ofter soon wears out his welcome. But upon the earnest solicitation of our worthy secretary, placing the matter so strongly before me "that practical papers are ever interesting and profitable," and asking my assistance, I consented, and will give you, in my humble capacity, a practical experience.

The subject I have chosen is, "Our artesian water supply," or, better still, "Our experience in drilling artesian wells for a water supply." I trust it will be interesting and instructive to the members of this association.

On May 7, 1881, a proposition was made to the city of Madison, Wisconsin, by a water company for the erection and maintenance of a system of water works, to supply water both for fire and domestic purposes. Proposition was to take the water from Fourth Lake, or Lake Mendota, which borders on our city. The suction pipe was to be not less than eighty rods in length from the shore, and to extend into at least forty feet depth of water.

This proposition brought on the agitation for a system of water works, and the question arose whether the city would be able to support such an undertaking.

The next question that attracted attention was whether the water works should be owned and controlled by the city or a company. After due deliberation, the common council decided that the city should own and control its own water supply. A committee on construction was appointed by the mayor to proceed forthwith to examine into the details, and to have plans and specifications prepared.

The most important question that appeared to the committee was "*Water.*"

Shall it be taken from Lake Mendota, or drawn from artesian wells, and will artesian wells be a success?

The committee on construction was composed of nine members; five favored artesian wells and four Lake Mendota. The engineer of construction favored the lake also.

The reasoning of the five members was: *Water* must bring financial success; the people will prefer their wells to lake water; therefore, to secure sufficent water-takers to carry on the work successfully, we must give a better water than the supply from the ordinary wells.

We all know the abhorrence people have to drinking lake water. Rather would our citizens drink the water from their wells, teeming with seepage, from underground contamination, than lake water.

Artesian wells thus far, to our knowledge, had not been resorted to for a public water supply, therefore a conundrum.

The first question was, Could we reach a supply? and, secondly, Would the supply be sufficient?

Notwithstanding the uncertainty, a contract was made for one or two six-inch wells; and it was decided to locate the pumping-station on low grounds near Lake Mendota, so that, in case the wells were a failure, we could resort to the lake.

For your information, I would say that Lake Mendota is a beautiful sheet of water; it is nine miles long and six miles wide. Its greatest depth is ninety feet. It is fed along the western shore by large springs, and, to all appearances, by springs from the bottom. Still, withal, the analysis made in 1888 by Prof. W. W. Daniells, Chief Chemist of the University of Wisconsin, showed a considerable amount of organic matter, not from sewage, but of vegetable origin, rendering the water unfit for domestic use without previous boiling.

The water for the analysis was taken on both sides of a bar or ridge that runs through the lake from northeast to southwest, and reaches up to and within five feet from the surface of the lake. On the slope of this bar, covered with large boulders, and appearing to the eye free from all vegetation, we took the soundings at from seven to eight feet from bottom.

The examination of four samples of water gave the following result:

No. 1, marked "51 feet sounding, 8 feet from bottom."

One million parts of the water contains 1.6 parts chlorine.

One million parts of the water, in 15 minutes, consumes 5.04 parts of oxygen.

One million parts of the water, in 30 minutes, consumes 6.3 parts oxygen.

One million parts of the water, in 45 minutes, consumes 12.0 parts of oxygen.

One million parts of the water contains 0.392 parts free ammonia.

One million parts of the water contains 0.288 parts albuminoid ammonia.

No. 2, marked "40 feet hole, 7 feet from bottom, 200 feet from bar. Sound on bar, 21 feet."

One million parts of the water contain 1.5 parts chlorine.

One million parts of the water consumes, in 15 minutes, 2 parts of oxygen.

One million parts of the water consumes, in 30 minutes, 3.1 parts oxygen.

One million parts of the water consumes, in 45 minutes, 4.6 parts oxygen.

One million parts of the water contains 0.202 parts free ammonia.

One million parts of the water contains 0.254 parts albuminoid ammonia.

No. 3, marked "From 64 foot sound at 56 feet."

One million parts of the water contains 1.6 parts chlorine.

One million parts of the water, in 15 minutes, consumes 2.42 parts oxygen.

One million parts of the water, in 30 minutes, consumes 2.85 parts oxygen.

One million parts of the water, in 45 minutes, consumes 3.10 parts oxygen.

One million parts of the water contains 0.201 free ammonia.

One million parts of the water contains 0.284 albuminoid ammonia.

No. 4, marked "40 foot sound, 8 feet from bottom."

One million parts of the water contains 1.6 parts chlorine.

One million parts of the water consumes, in 15 minutes, 1.5 parts oxygen.

One million parts of the water consumes, in 30 minutes, 1.9 parts oxygen.

One million parts of the water consumes, in 45 minutes, 3.1 parts oxygen.

One million parts of the water contains 0.226 parts free ammonia.

One million parts of the water contains 0.317 parts free ammonia.

This analysis shows a good and far better water than a great many cities are supplied with.

The location of our pumping-station is seemingly an old lake bed, which gave the well-drillers any number of obstacles to contend with. Nests of boulders were found from four to eight feet in thickness, and from forty to eighty feet below the surface.

The drift overlaying the water-bearing rock, which with us is mostly potsdam, was 189 feet from surface. At 198 feet we found another four feet of sand and gravel; we

therefore continued carrying our well tubing down to 218 feet, so as to be sure that we excluded all organic matter. We then continued drilling till we reached granite, or traprock, which was found at the depth of 751 feet.

The well, while being drilled, was always full of water. When this well was completed, and we found we had met with great success, you may imagine our satisfaction. The water overflowed in a steady stream four and a half feet over and above the surface of Lake Mendota.

A test was made of the well with a fire steamer, which showed a capacity of 350 gallons of water per minute. We then had an analysis made of the water by Prof. Daniells, which showed the following contents in a total per U. S. gallons of 231 cubic inches, and the ingredients are as follows:

Potassium sulphate	0.237
Sodium sulphate	0.286
Sodium phosphate	Trace
Bi-carbonate of soda	1.094
Bi-carbonate of lime	15.224
Bi-carbonate of magnesia	12.984
Bi-carbonate of iron	0.214
Sexqui-oxide of aluminum	Trace
Silica	0.414
Organic matter	None
Total solid contents per gallon	30.745

The temperature of the water is 51°.

Below I will give the analyses of the waters of the Bethesda, Hygeia, White Rock and Fountain Spring, of Waukesha, Wisconsin, as given in Volume II, Geology of Wisconsin, 1873–1877, and our city water in comparison. These waters are noted for their medicinal qualities.

	Artesian Wells Madison City Waterworks—Daniells.	Bethesda Springs Waukesha — Chandler.	Hygeia Springs Waukesha — Thiele.	White Rock Springs, Waukesha — Bode.	Fountain Springs Waukesha — Blaney.
Chloride of sodium.........	0.292	1.160	1.250	1.170	Trace
Bi-carbonate of lime........	15.224	17.022	16.726	11.716	13.778
Bi-carbonate of magnesia...	12.984	12.388	13.142	5.311	9.195
Bi-carbonate of soda........	1.094	1.256	2.265	1.181	1.021
Bi-carbonate of iron........	0.214	0.042	0.575	....	0.048
Sulphate of sodium.........	0.286	0.542	0.524	1.091	0.360
Sulphate of potassia	0.237	0.454	0.820	....	....
Phosphate of soda..........	Trace	Trace	0.040	....	....
Alumina....................	Trace	0.122	0.720	....	0.097
Silica......................	0.414	0.741	0.150	1.036	0.554
Organic matter.............	None	1.983	Trace	....	0.311
Total per U. S. gallon of 231 cubic inches........	30.745	35.710	36.212	21.505	25.364

In Volume II, Geology of Wisconsin, 1873–1877, we read of the Waukesha waters as follows: "The source of the substances found in these springs is quite clear. The salts of lime, magnesia, silica, alumina and iron are the rock substances dissolved, these being the essential constituents of the strata from which the waters flow, or through which they have percolated. It is to be noted that the relative proportion of these substances in the analysis bear a close correspondence to that which they sustain in the rock. The compounds of sodium and potassium are for the most part those found in sea waters, whence they were derived at the time of the deposition of the formations beneath the silurian ocean. The leaching of ages has not sufficed to completely remove them from the interior of the strata, and these analysis show that they are still being dissolved out and borne back to the ocean. The small amount of organic matter in these springs is doubtless derived from the surface by the descending water." Our water has not even the slightest trace of organic matter. Prof. Chamberlin further says: "The use of these waters has been recom-

mended by many physicians of high standing, and the results that have attended such use have been of a highly satisfactory character."

With this success, we commenced to drill another six-inch well, locating it fifty-five feet northeast from this first well, and carried it down to same depth as the first well, as also the tubing. This well seemed to interfere with the first well; we then located another eight-inch well fifty-five feet northeast to east from the second well, and our capacity increased to 600 gallons per minute. Our understanding and information at command was, all we had to do was to drill within a certain radius of forty feet and we would get plenty of water. All that was necessary was to tap the underlying reservoir.

As we did not meet the anticipated abundance of water, we located the next eight-inch well seventy-seven feet northwest of the second well. Here we discovered that we connected with the current of water that supplied the artesian well in the Capitol grounds, 2,063 feet from this well, which has same depth as ours, necessitating the lowering of their pump five feet.

As our supply was not sufficient, we were obliged to change tactics entirely. We concluded to try our luck at a distance of 1,225 feet in a northeasterly line from third well with an eight-inch well and at same depth as other; the result was an additional supply of 320,000 gallons of water in twenty-four hours.

Our water-takers increased, and with them the waste. We were obliged to get more water. Another eight-inch well was decided upon, and on the advice of experts we located this well 700 feet east from the third well and 700 feet south from fifth well. Here we ran into same current again that supplied the fifth well, and we only gained 80,000 gallons per day. What next? We were getting to the end of our rope, as it seemed. We found the current of water that furnished the supply must be running from north to south.

The next step was two eight-inch wells only 226 feet deep, tubing 218 feet deep, drawing water through a depth of only eight feet.

These wells gave us 80,000 gallons each per day. We were getting at our wits ends. The consumers and the waste kept increasing, but not the water in proportion. Woe to any one that would talk of a lake connection!

The president of the water board and your humble servant, being members of the original construction committee, having taken a decisive stand against a lake connection at that time, still felt so inclined. What must and could be done? The decision arrived at was, first to stop the misuse of water, by adopting a "general meter system," and then consider a further increase in the water supply. In May, 1888, the meter system was adopted in spite of an almost unanimous opposition from the water-takers, they not knowing and understanding our precarious situation.

This step brought us like a Phœnix out of our dilemma.

Our experience and results of a general meter system, given you on previous occasions, is still fresh in your memory.

After the meters had been placed very generally, the well question was again considered.

I attended the convention of our association at Milwaukee, Wis., in 1893, where the artesian water supply was the leading topic, both by Prof. E. G. Smith, of Beloit, Wis., and D. W. Mead, of Rockford, Ill., giving us very valuable papers on the subject.

Here I found the long sought for information. Let me say right here, that the benefits we derive at these gatherings of our association, not only by listening to the papers prepared for the occasion, but also in conversation and exchange of thought, is invaluable, and bears its fruit.

I placed our situation before Prof. Smith, asking whether it would be safe to drill more wells. He answered, Yes. Do not fear, you will get more water. Only change the course

heretofore chosen. There is plenty of water, but its course is from north to south; therefore you must drill your wells either direct east or west from each other, and say at a distance of 1,000 feet apart, as the laterals feed within a radius of 400 feet.

We followed the advice, and made a contract for two ten-inch wells down to granite. The ninth, or first of these two wells, we located in an easterly direction 1,050 feet from fifth well, which meant 2,275 feet from the pumps. We made a forty-eight hours test of this well; water receded to eighteen feet from surface, where it remained stationary and showed at this point a capacity of 599,040 gallons of water in twenty-four hours. After we reached the depth in this well of 740 feet we found a red and blue calcareous clay down a depth of eighty-one feet, when, instead of finding said and gravel as a natural consequence of geology, we reached the decomposed diabase rock overlying the granite, same as in the other wells. The depth of this well in consequence is 821 feet. The next, or tenth well, we located again direct east of the ninth well at a distance of 1,235 feet, or 3,500 feet in direct line from the pumping station. This well with the same test as at the ninth well showed the same capacity. In this well we found the trap-rock or granite at 736 feet.

In the drilling of all these wells, we endeavored to have the well drillers preserve the correct formations of the soil and rock penetrated, and as found down to the bottom, but we succeeded only in two instances, viz., in the fourth and tenth wells.

The formations of the fourth well were handed to the late Prof. R. D. Irving, professor of geology of the University of Wisconsin at that time, for examination. These formations were lost during the destruction of Science Hall by fire December 1, 1884, while being examined. Fortunately we had preserved a duplicate; these we had examined later by E. R. Buckley, Ph. D., geologist in charge of economic

geology, University of Wisconsin, and are herewith given. Prof. Buckley discovered that some of the formations were misplaced.

ARTESIAN WELL No. 4.

No. of feet below surface.	Thickness of bed.		
1– 30	30 feet	Sand and fine gravel.	Drift.
30– 40	10 feet	Calcareous sand.	Drift.
40–105	65 feet	Calcareous clay.	Drift.
105–140	35 feet	Yellow sandstone.	Potsdam.
140–159	19 feet	Speckled white sandstone.	Potsdam.
159–160	1 foot	Ferruginous sandstone.	Potsdam.
160–179	19 feet	Speckled sandstone.	Potsdam.
179–189	10 feet	Calcareous sandstone.	Potsdam.
189–193	4 feet	Slightly ferruginous sandstone.	Potsdam.
193–230	37 feet	Calcareous sandstone.	Potsdam.
*230–468	*238 feet	Slightly calcareous sandstone.	Potsdam.
468–478	10 feet	Ferruginous calcareous sandstone.	Potsdam.
478–720	242 feet	Coarse white sandstone.	Potsdam.
720–750	30 feet	Fine grained clayey sandstone.	Potsdam.

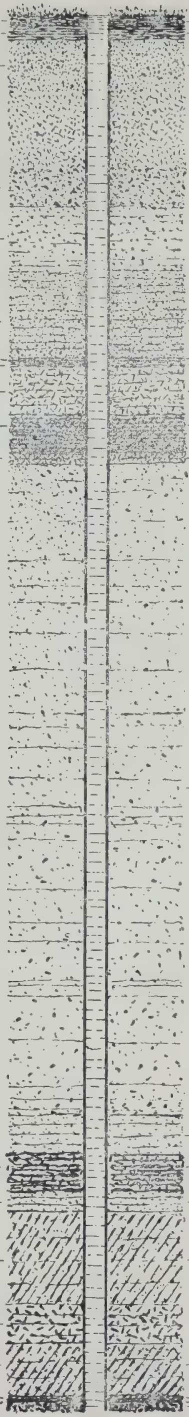
*The specimen which represents this bed was undoubtedly taken from the upper or lower portion. It is believed that the greater portion is not calcareous.

The exact geological formations penetrated in drilling well No. 10, examined by C. R. Van Hise, professor of geology of the University of Wisconsin, and chief of the Lake Superior Division under the Geological Survey of the United States, is herewith appended by an illustration. It is very instructive and shows a potsdam formation of 631 feet.

We have also preserved the formations in a glass tube in the office of the water department, showing the well in miniature.

We are now in a position to furnish all the water demanded of us, up to double our present population, and in case more water is needed we can drill more wells. Aside from that, we have water that but few cities can equal. I would recommend that all cities, where it is possible, adopt the artesian well supply, with the foregone conclusion in connection with a general meter system.

Formations Penetrated in Drilling Well No. 10.



DEPTH	THICKNESS	DESCRIPTION	
--4,	4 FT.	SANDY LOAM	DRIFT
4--12,	8 "	CALCAREOUS CLAY	DRIFT
12--40,	28 "	SAND AND FINE GRAVEL	DRIFT
40-80,	40 "	CALCAREOUS SAND	DRIFT
80-100,	20 "	SAND AND GRAVEL	DRIFT
100-135,	35 "	WHITE COARSE GRAINED SANDSTONE	POTSDAM FORMATION
135-180,	45 "	YELLOW SANDSTONE	POTSDAM FORMATION
180-182,	2 "	GREEN SHALE	POTSDAM FORMATION
182-185,	3 "	ARENACEOUS LIMESTONE	POTSDAM FORMATION
185-210,	25 "	CALCAREOUS SANDSTONE	POTSDAM FORMATION
210-230,	20 "	CALCAREOUS FERRUGINOUS SHALE	POTSDAM FORMATION
230-235,	5 "	CALCAREOUS SANDSTONE	POTSDAM FORMATION
235-580,	345 "	SPECKLED WHITE SANDSTONE	POTSDAM FORMATION
580-600,	20 "	WHITE SANDSTONE	POTSDAM FORMATION
600-620,	20 "	COARSE GRAINED CALCAREOUS SANDSTONE	POTSDAM FORMATION
620-630,	10 "	SPECKLED WHITE SANDSTONE	POTSDAM FORMATION
630-680,	50 "	FERRUGINOUS SANDSTONE	POTSDAM FORMATION
680-700,	20 "	COARSE GRAINED CALCAREOUS SANDSTONE	POTSDAM FORMATION
700-728,	28 "	FERRUGINOUS SANDSTONE	POTSDAM FORMATION
728-730,	2 "	HIGHLY FERRUGINOUS SANDE	POTSDAM FORMATION
730-731,	1 "	HIGHLY FERRUGINOUS SHALE	POTSDAM FORMATION
731-736,	5 "	MUCH DECOMPOSED DIABASE	

Prof. T. C. Chamberlin, Chief Geologist, in Volume II, Geology of Wisconsin, says: "So far as possible, all cities should be supplied by water from springs or artesian wells." Again he says: "The water from this source usually has a temperature of 48° to 50°, and is clear and comparatively free from organic impurities, but contains a small percentage of the carbonates of lime and magnesia, and in some cases a very small percentage of iron, with usually some silica, alumina and chloride of sodium. But the combined amount of these is small, and the water is soft and very pleasant to the taste. A small amount of free carbonic acid is usually present, which enhances the grateful effect of the water upon the palate and stomach."

When a city or water company decides on an artesian water supply, it is well, before proceeding, to get all information on the subject. Where an artesian well supply eighteen years ago was a conundrum, to-day it is a well developed and an established fact.

Smaller cities should not hesitate to look into the matter. They can avoid the expense we had to incur from the experience of others and the development in the geological formations of almost every state in the Union.

The cost of our ten wells, including the suction pipe, was $37,241.82. A lake connection with us, properly cribbed and filtered, would have cost us at least $35,000, and then an impure water and with less income. One fact more I wish to mention, and that is there are a great many wells sunk by water-works people that are shallow, sometimes no deeper than an ordinary well, and with the expectation of pure water. How is it possible? At most it is only surface water. It cannot be otherwise. It is bound to show vegetation. It is a constant source of annoyance to the managers and danger to the consumers.

By securing a pure water supply, you will secure more consumers, and can collect a better rate. It is cheaper in the end.

Our total feet of suction pipe, connecting with all the wells, is 6,279 feet. Of these there are 1,650 feet of 16-inch and 3,155 feet of 12-inch pipe for the main suction. With this main line there are branch connections of 10-inch, 8-inch and 6-inch, according to the size of the well and the distance from the main suction pipe.

Around the opening of each well we place a well-drum, thoroughly calked to the well tubing. On the side of this well-drum there is an opening for the suction pipe large enough to allow calking to be well done. This well-drum is carried up to the surface of the ground, where it is well sealed with a heavy cover, snugly fitted, to prevent any surface drainage to creep into our wells, and at the same time to act as an aid to the pumps by the atmospheric pressure, creating an elasticity to the suction. (See illustration.)

It was my intention to give further information as to the probable results of artesian wells in other states beside my own, and placed myself in communication with Prof. Chas. D. Walcott, Director of the United States Geological Survey at Washington, D. C., under the Department of the Interior, and Prof. C. R. Van Hise, Department of Geology and Mineralogy of the University of Wisconsin, and Geological Survey of the United States, but, as my time was limited, it was impossible for me to give the same.

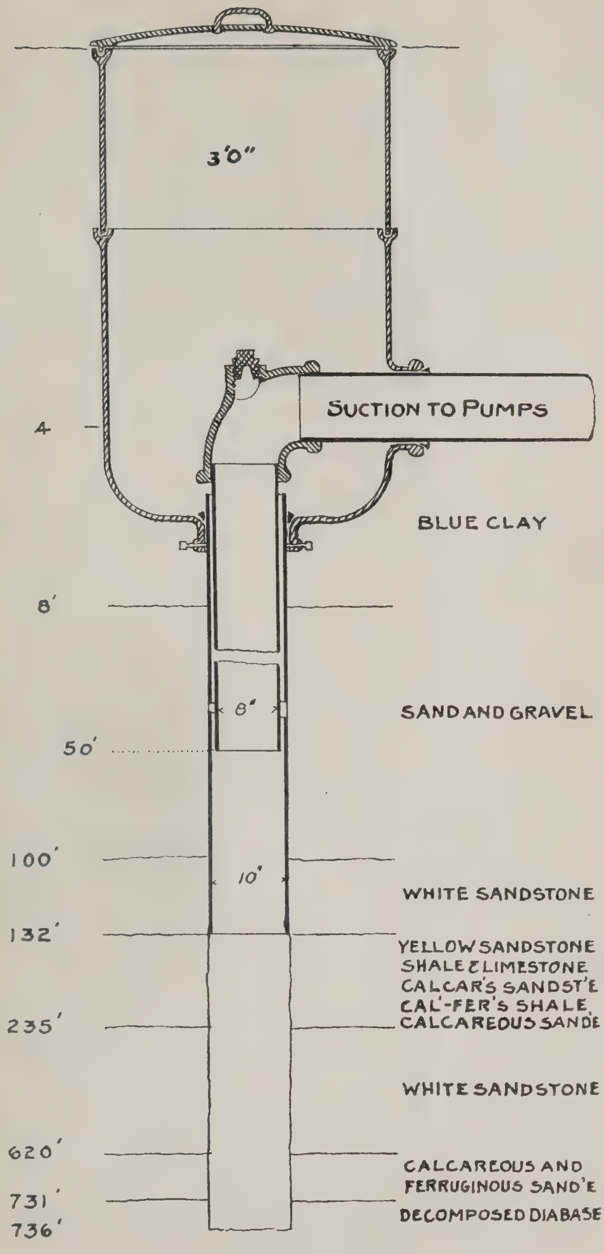
For the benefit and as index to such members that desire to further investigate the desirability of drilling artesian wells in their own community, I have attached the answers received from both Prof. Walcott and Van Hise.

DEPARTMENT OF THE INTERIOR,
UNITED STATES GEOLOGICAL SURVEY,
WASHINGTON, D. C.

MR. JOHN B. HEIM,
Madison, Wisconsin,

Dear Sir: — Your letter regarding artesian conditions in the United States has been received. This is a matter concerning which the Division of Hydrography is making sys-

CAST-IRON WELL-DRUM



FORMATIONS PENETRATED IN DRILLING WELL No. 10.

tematic investigations, the results of which have been published in part or are now in the hands of the printer.

I suggest that you consult the various reports of this survey to be found in the library of the university, or of the state, at Madison; particularly the Seventeenth Annual Report, Part II; the Eighteenth Annual Report, Part IV; the Nineteenth Annual Report, IV; also Bulletin No. 138, and the Pueblo, Colorado, atlas folio, prepared by Mr. G. K. Gilbert. I have sent Water Supply Papers Nos. 12, 21 and 26.

The conditions in many parts of the United States are favorable for artesian waters, but vary so much that it is impossible to give a brief general statement of these. The depth also differs from a few feet to several thousand, as you will see by consulting the various reports.

Yours with respect,

CHARLES D. WALCOTT, *Director.*

Paper No. 12 treats on the underground waters of Southeastern Nebraska by N. H. Darton. No. 21 on wells of Northern Indiana, and No. 26 on wells of Southern Indiana, both by Frank Leverett.

UNIVERSITY OF WISCONSIN,
DEPARTMENT OF GEOLOGY AND MINERALOGY.
MADISON, WIS.

Superintendent JOHN B. HEIM, City,

My Dear Sir: — Your letter asking for information concerning artesian wells is at hand. The subject is such a large one that I would be unable to give you anything of value in a letter, so I refer you to a number of general papers from which you can get the information you desire.

Chamberlin has written about the artesian wells of Wisconsin in the reports of the old Wisconsin Geological Survey. This account can also be found in Chamberlin's Geological Papers.

N. H. Darton has reported on the artesian well of the coastal plains of the United States in Bulletin 138 of the United States Geological Survey. He has also reported on the artesian wells of the Dakotas in Part II of the Nineteenth Annual Report of the United States Geological Survey. In the same volume Frank Leverett has reported on the artesian wells of Illinois.

You may have access to all of these volumes at our University Library or at the State Historical Library.

Very truly yours,

C. R. VAN HISE.

Since looking up this subject, I find that artesian water supplies have been very successful in some of the southern states, through the information that I have been able to gather, through the correspondence with the respective state geologists of the several states, and will give you the answers and title of publication of those that I received, to serve also as an index to such that desire to further investigate the artesian water supply.

The answer of Prof. Smith is herewith given:

GEOLOGICAL SURVEY OF ALABAMA.
UNIVERSITY, ALA., April 12, 1900.

MR. JOHN B. HEIM,

Dear Sir: — I have received your circular of the 9th with reference to artesian water supply to cities. All the large towns in the Alabama coastal plain, *i. e.*, in the cretaceous and tertiary formations, have their city water works based upon the supply furnished by artesian wells. Thus, Montgomery, Union Springs, Selma, Demopolis, Eutaw and Mobile in part. The smaller towns have these wells in different parts of the towns, and the people get their water from these, where they do not have pipe lines. In Mobile, part of the water for the city is obtained from some large springs at a short distance from town. In Greensboro they have artesian wells, but I do not know whether or not they have a reservoir with supply pipes leading from it. The last time I was there they were boring wells. You may take it as a fact that all the towns and cities on the coastal plain get water from artesian wells, and either pump it into reservoirs or have it running at hydrants or reached by pumps direct from the well.

In Oxford, Miss., they have sunk some wells to the depth of 140 or 150 feet, where they get a good supply of water, which, however, has to be raised over 100 feet to the surface. Thence it is pumped into reservoirs, and thus the university and town are supplied. I have no bulletin as yet on this subject, but expect to get the data for one this coming summer. Yours very truly,

EUGENE A. SMITH.

Herewith is the answer of Prof. Holmes:

North Carolina Geological Survey.
Chapel Hill, N. C., April 13, 1900.

Mr. John B. Heim,
Water Works Department,
Madison, Wis.

Dear Sir: — In response to your letter of 9th I beg to say that a great deal of information concerning the artesian water supplies along the south Atlantic and Gulf coast is furnished in Bulletin No. 138 by Mr. N. H. Darton, recently published by the United States Geological Survey, Washington, D. C. The price of this bulletin is 20 cents, which should be sent in coin to the director of United States Geological Survey, Washington, D. C. A still more recent publication on the artesian water supplies of Georgia can be obtained from Prof. W. S. Yeates, State Geologist, Atlanta, Ga. I regret to say that our report on the artesian water supplies in the two Carolinas has not yet been published.

Yours truly,
J. A. Holmes,
State Geologist.

Prof. Stafford answered:

Nashville, Tenn., April 13, 1900.

John B. Heim,
Madison, Wis.

Dear Sir: — I herewith mail you a report of mine on the Artesian Water Supply of Memphis, Tenn. This is all I can at present supply you with.

Yours truly,
Jas. M. Stafford.

In answer, Prof. W. S. Yeates, State Geologist, Atlanta, Georgia, forwarded a very comprehensive report on the artesian well system of Georgia, entitled Bulletin No. 7, by S. W. McCallie, Assistant Geologist. It is a very valuable document, discussing the artesian wells in general and of the state of Georgia.

Parties desiring to drill wells for a public water supply should not fail to secure a copy from Prof. Yeates.

I am sorry that I have been unable to give you the information I had intended on account of the limited time at my command, but I trust I have awakened an interest for a further development of a public artesian water supply.


MADISON
AND
THE FOUR LAKES
STATE CAPITOL.
PARK HOTEL.
N
W
E
S
MENDOTA.
FOURTH LAKE
PICNIC POINT
MONONA
THIRD LAKE.
WINGRA
WAUBESA
SECOND LAKE.
KEGONSA
FIRST LAKE.
STONE FACE
STATE HOSPITAL
ROCKY ROOST
MAPLE BLUFF
OAK LODGE
FOX'S BLUFF
WACONIA
BLACK HAWK
EAGLE HEIGHTS
STEAMBOAT DOCK
UNIVERSITY BOAT HOUSE
EDGEWOOD ACADEMY.
WINNEQUAH
HOBOKEN BAY
SCHUETZEN PARK
ELMSIDE.
TONYAWATHA SPRINGS
LOUGEE'S SHOOTING BOX.
CAMPS AND LODGES
BROWN'S BLUFF.
SUGAR BUSH
CAMP COLLINS
C.&N.W.R.R.
C.M.&ST.P.R.R.
8 MILES FROM CAPITOL.

City Water Department

Nineteenth Annual Report

Madison, Wis., 1901

COMPLIMENTS

John B. Heim

SUPERINTENDENT.

Please Exchange.

THE PUMPING STATION.

NINETEEEENTH ANNUAL REPORT

OF THE

BOARD

OF

WATER COMMISSIONERS

OF THE

CITY OF MADISON

For the Year Ending September 30, 1901

TOGETHER WITH THE

REPORTS OF THE SUPERINTENDENT AND SECRETARY

MADISON, WIS.:
MADISONIAN PRINT.
1902

LIST OF WATER COMMISSIONERS.[1]

Under whose charge the Water Works was placed, and time served.

COMMISSIONERS.

*James Couklin..1884–5–6–7–8–9
*H. Christoffers 1884–5–6–7–8–9–90–1–2–3–4
R. M. Bashford[2]...................... 1884–5–6
John Lamont[3]................................ 1886–7–8–9–90–1–2–3
A. Donovan 1889–90–1–2
John R. Melvin.............................1892–3–4–5–6–7–8–9–0–1
W. W. Warner........... 1893–4–5–6
J. J. Silbernagel.................................1894–5–6–7–8–9–0–1
J. Van Etta...1896–7–8–9–0–1

EX-OFFICIO.

*H. N. Moulton,[4] Mayor.....1885–6
A. Donovan, Alderman......1885–6

E. W. Keyes, Mayor.........1886–7
M. J. Cantwell, Alderman...1886–7

*James Conklin, Mayor.....1887–8
G. J. Corscot, Alderman.....1887–8

M. R. Doyon, Mayor........1888–9
S. G. Oakey, Alderman......1888–9

M. R. Doyon, Mayor.......1889–90
E. L. Baker,[5] Alderman....1889–90
F. C. Sheasby,[6] Alderman..1889–90

R. M. Bashford, Mayor......1890–1
H. Schulkamp, Alderman...1890–1

W. H. Rogers, Mayor......1891–2–3
H. Schulkamp, Alderman.1891–2–3

John Corscot, Mayor........1893–4
R. F. Taylor, Alderman 1893–4

John Corscot, Mayor 1894–5
W. C. Noé, Alderman.......1894–5

Jabe Alford, Mayor.........1895–6
W. H. Lansing, Alderman...1895–6

A. A. Dye, Mayor...........1896–7
Ed. Quammen, Alderman...1896–7

*M. J. Hoven, Mayor........1897–8
Ed. Quammen, Alderman... 1897–8

Chas. E. Whelan, Mayor....1898–9
Ed. Quammen, Alderman....1898–9

*M. J. Hoven, Mayor.....1899–1900
Ed. Quammen, Alderman 1899–1900

*M. J. Hoven, Mayor........1900–2
Ed. Quammen, Alderman...1900–1

Storm Bull, Mayor..........1901–1
Ed. Quammen, Alderman...1901–2

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1 First commissioners elected April 15, 1884.
2 Resigned March 1, 1886.
3 Elected to fill vacancy.
4 Mayor and alderman ex-officio added to board April, 1885.
5 Resigned.
6 Elected to fill vacancy.
* Deceased.

OFFICERS OF THE WATER WORKS.

JOHN R. MELVIN, President	Term expires October 1, 1904
J. J. SILBERNAGEL....................	Term expires October 1, 1903
J. VAN ETTA..........................	Term expires October 1, 1902
STORM BULL....	Mayor, *ez-officio*
EDWARD QUAMMEN..................	Alderman, *ex-officio*

O. S. NORSMAN, Secretary

SUPERINTENDENT

JOHN B. HEIM

METER INSPECTORS

NICHOLAS REIF

FRANK T. HAYES

ENGINEERS

PETER GAUER

DENNIS DACEY

AUSTIN GANNON

FIREMEN

JOHN LYONS

FRED. RODEFIELD

WATER WORKS OFFICE

CITY HALL, SECOND FLOOR

Regular meetings of the board Wednesday previous to common council meeting of each month at 3 o'clock P. M.

All bills against the department must be rendered on or before the 28th of each month, or they will lie over until the following regular meeting.

Water rents are due and payable, in advance, at the office of the City Treasurer on the first days of January and July of each year.

CITY ORDINANCE

"*All water rents shall be paid semi-annually the first days of January and July of each year in advance; any water rents, whether by schedule or meter*, which shall not be paid within thirty days after the same become due and payable, shall be increased by a penalty of ten per cent., and if the same shall not be paid, together with the penalty thereto attached, within ten days after the same become due and payable, the water shall be shut off from the consumer so in default."

LAWS RELATING TO WATER WORKS.

EXTRACTS FROM CITY CHARTER, ADOPTED 1882.

SECTION 8. Any person who shall wilfully or maliciously injure or destroy any portion of the works, fixtures or other property belonging or appertaining to said water works, or who shall wilfully pollute or otherwise injure any water supplied by said water works, or who shall wrongfully interfere with, or open any hydrants or waste any water therefrom, shall be deemed guilty of a misdemeanor, and upon conviction thereof, shall be punished by a fine not exceeding one hundred dollars, or imprisonment in the county jail not exceeding six months, or by both such fine and imprisonment, in the discretion of the court.

SECTION 9. It shall be the duty of the common council, and it is hereby empowered, from time to time, to pass such ordinances as may be deemed necessary or expedient for the management and proteetion of said water works, and regulating and controlling the supply and use of water therefrom; and the council is hereby empowered, when it shall deem it for the best interests of the eity, so appoint a board of three water commissioners, to take the entire charge and management of said water works, to appoint a superintendent and other employees, to fix their compensation, and to supervise and control the supply and distribution of water throughout the city, and generally to discharge the duties imposed upon the common council by this chapter, under the general control and supervision of said council; but such commissioners shall receive no compensation for their services.

REPORT OF THE COMMISSIONERS.

Office of the Board of Water Commissioners,
City of Madison, Wis.,
March 1, 1902.

To the Honorable the Mayor and Common Council:
Gentlemen:

We have the honor to submit herewith our nineteenth annual report, covering the operations of the water works department of this city for the year ending September 30, 1901.

The reeeipts of the department from all sources were $33,-992,81, of which $28,455.91 were from water rents and water permits, $5000 from the general city tax of 1900, and the balance from miscellaneous sources.

The total expensess during the year were $34,733.14, including $5.200 for the new addition to the pumping station and $5000 transferred to the sinking fund, as required by the city charter. This $5000 was used by the city in taking up on April 1st last of $6000 of the original water works bonds issued in 1882. This leaves only $2000 of the original $76,000 issued, now outstanding, and these will be paid on April 1st next. There will remain then the $10,000 issued for water works extensions in 1893, and the $10,000 issued for like purposes last year. The bonds issued in 1893 are payable at the option of the city on and after January 1st, 1904.

The all important question now before this board is that of providing an adequate water supply. While no decisive steps have yet been taken in this matter, the subject has been and is being carefully add earnestly considered, and we would most respectfully ask the united support of your honorable body for such plans to provide an increased water supply, as we shall find feasible and expedient after consultation with the city engineer, and if necessary, other expert assistance. Whatever is to be done should be done as speedily as possible. It was the

expectation of this board that with the installation of the new pumping machinery which has been accomplished during the year just past, together with the lowering of the suction, that a considerable increase in the water supply would result, but this was not realized on aecount of leaks in the pipes, which however, are being looked after and will be remedied in time. But it is useless to deny that further steps must be taken immediately to increase the water supply.

The report of the superintendent on this and other important features of the operations of the department is submitted herewith, and we respectfully bespeak for the recommendations made by him your fair consideration and support.

Respectfully submitted,

J. R. MELVIN,
J. J. SILBERNAGEL,
J. VAN ETTA,
STORM BULL,
ED. QUAMMEN,
Commissioners.

SECRETARY'S STATEMENT.

Of receipts and expenditnres of the water department of the city of Madison, for the year ending September 30, 1901:

RECEIPTS.

Balance on hand Oct. 1, 1900	$7,233 92	
Water rents collected	28,021 51	
Water permits collected	434 40	
Plumbers licenses	10 00	
Lead pipe and material sold	21 00	
Old iron and brass sold	17 23	
Collected for extra sorvice connections	340 49	
Meters sold	100 00	
Neptune Meter Co. rebate on meters	47 50	
From general tax, 1900	5,000 00	
		$41,226 73

EXPENDITURES:

Construction expenses	$12,510 87	
Operating expenses	11,019 10	
Repair expenses	977 67	
New addition to pumping station	5,200 00	
Transferred to sinking fund	5,000 00	
Water rent refunded	25 50	
Balance on hand, Oct. 1, 1901	6,493 59	
		$41,226 73

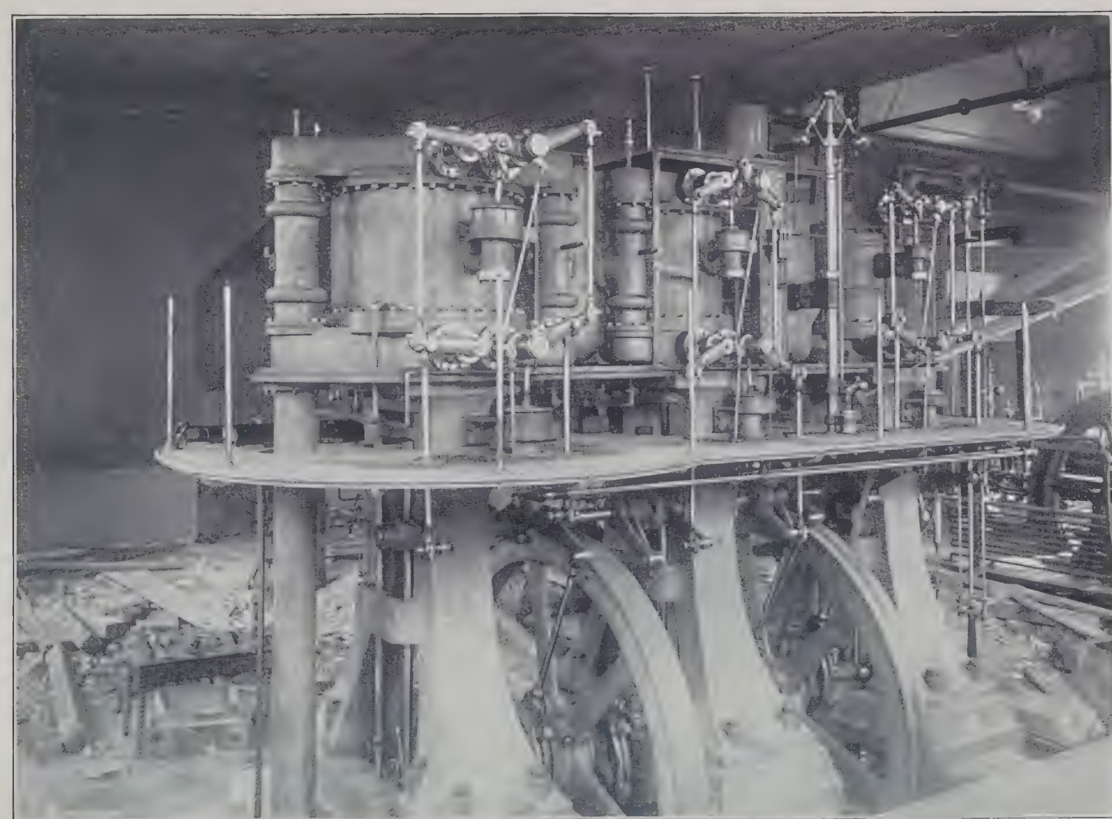
MISCELLANEOUS.

Total receipts from water rents to Oct. 1, 1901	$312,052 72
Total receipts, water permits	6,118 40
Total operating expenses	183,390 40
Total construction expenses	349,871 00
Total cost of repairs	12,368 61
Cost of new boilers	3,675 00
New addition to pumping station	5,200 00
Amount of bonds issued for construction of plant	76,000 00
Amount of this issue outstanding	2,000 00
Water works extension bonds issued in 1893	10,000 00
Water works extension bonds issued in 1901	10,000 00
Total water bonds now outstanding	22,000 00

Respectfully submitted,

O. S. NORSMAN,

Secretary.



THE ENGINE PART OF THE PUMPS UNDER CONSTRUCTION.

REPORT OF THE SUPERINTENDENT.

MADISON, WIS., February 16, 1902.

To the Honorable, the Board of Water Commissioners:

GENTLEMEN:— Complying with the city ordinances, I present herewith the nineteenth annual report of the water department, for the year ending September 30, 1901. The report shows the financial condition, the work performed during the past year, together with such recommendations as are actually necessary.

FINANCIAL.

The financial condition of the department as will be seen by the secretary's statement, has not only equaled the past years, but surpassed them beyond expectation.

The department carried on its own work in extensions, additions and improvements from its own resources as it has since 1896, and has also placed $5,000 into the bond fund.

The net receipts for the year were $41,226.73. The total expenditures for construction, operation, water meters, repairs, and the new addition to the pumping station, this includes the $5,000 placed in the sinking fund, was $34,733.14, and left a balance on hand September 30, 1901, of $6,493.59.

We added 208 new water takers which are under the meter system, and thirteen of the old takers were added to the meter system.

The total cost of the water works since construction to year ending September 30, 1901, was $349,871.00. The net receipts from all sources including permits, was $122,352.11, leaving a net sum of $227,518.89 for construction. Deducting the interest paid on the bonded indebtedness since construction in the sum of $45,700.00, gives a net earning of 20 per cent.

With the purchase of the new pumps, we were obliged to increase our bonded indebtedness $10,000.00, so that our bonded

indebtedness is now $22,000.00. $2,000.00 of this amount will be paid April 1, 1902.

NEW PUMPS.

The expectation of having the new pumps ready for operation by May 1st, 1901, was a disappointment, caused by the great strike, which delayed the erection and completion, for acceptance by the city until late in December, and then they were not ready for operation on account of the delay by the contractor with the addition to the pumping station, through the delay of the machine men, until the 25th of January, 1902.

The following is the duty test made by Mayor Storm Bull, professor of steam engineering of the University of Wisconsin:

MADISON, WIS., December 11, 1901.

To the Honorable, the Board of Water Commissioners, City of Madison, Wis.:

GENTLEMEN:—Acting under your instructions I have represented the city at the test of the new pumping engine at the water works station and conducted by the representatives of the Allis-Chalmers Co. The contract calls for a duty of 125,000,000 foot lbs. per 1,000 lbs. of dry steam furnished the engine at 125 lbs. pressure, the engine running at 50 revolutions per minute; the capacity of the pump to be 3,000,000 gallons per 24 hours. It would of course have been desirable to have had a test of 24 hours duration. But it was impossible to do so because of the insufficiency of water furnished by the wells, this insufficiency being to a large extent due to the large quantities of air which leak into the suction pipes. In order to run the new pumping engine at a reasonable speed it was necessary to make the test at a time when the reservoir was entirely full, so that the pump might draw its water at least partially from the reservoir. Even under these circumstances it was found impossible to have the test last much more than two hours, as the water in the reservoir would give out in less than three hours. It was therefore agreed with the representatives of the Allis-Chalmers Co. that the test should begin at midnight between Tuesday and Wednesday, Dec. 3rd to 4th, and that it should last two hours, the engine to be run at such a speed that would come as nearly up to the contract

speed as possible. Several preliminary tests had been made, and at these it had not been found possible to run the engine at a higher speed than about 35 revolutions per minute. It will be seen, however, that at the test proper the average speed of the engine was 39.3 per minute, or 10.7 lower than the contract called for.

Three senior students in mechanical engineering from the University took part in the test. One of them took indicator cards from the three cylinders and besides took the necessary observations at the separating calorimeter, which observations were to serve to compute the moisture in the steam. The second student weighed the condensed water from the engine, and the third made the necessary observations on the pressure guage. The engine was run about one half hour before the test was started, and during that time the necessary inspection was made to see that everything was in good order: engine and testing apparatus. The test was started at 12:15 A. M. and lasted until 2:15 A. M. During these two hours 2590.5 lbs. of condensed steam was weighed out from the engine; the calorimeter showed that the average quality of steam was .96665; consequently the number of lbs. of dry steam used by the engines was 2590.5, multiplied by .96665, which gives 2504.1 lbs. dry steam. The average head during the test, counted from the vacuum in the section pipe to the pressure in the discharge pipe was 211.3 feet. The total number of revolutions was 4718, the area of the three plungers in the pump together is 405.9 square inches and the stroke of the pump is 24 inches; the weight of one cubic foot of water is 62.4 lbs., consequently the duty expressed in ft. lbs. per 1,000 lbs. of dry steam was:

$$\text{Duty} = \frac{405.9 \times 24 \times 4718 \times 211.3 \times 62.4}{1728 \times 2.504.}$$

$$\text{Duty} = 140{,}060{,}000$$

The duty of the engine during this two hours test was therefore slightly above 140,000,000, which is 15,000,000 above what the contract called for, certainly a very satisfactory result. It ought also to be stated that there is no question in my mind that if it had been possible to run the engine at the contract speed, 50 revolutions per minute, the duty obtained would have been still higher. As the pumping engine ran satisfactorily in

every way there could not be any doubt whatsoever but that the contractors had more than fulfilled the terms of the contract, it not being their fault that the water furnished by the wells was not sufficient.

Respectfully submitted,

Storm Bull.

Mr. John B. Heim, Superintendent Water Works, City:

Dear Sir:—As explained in the report to the Board of Water Works Commissioners, the test of the new pumping engine was made in the night between the 3rd and 4th of December, 1901. This report gives the final result obtained at the test, but it does not give any of the readings ot the instruments, etc., during the test. For the sake of completeness it is thought best to append some tables containing these readings, so that the results obtained can be verified at any time. The number of revolutions, pressure at discharge, vacuum or suction and pressure of steam were read every five minutes. The calorimeter used was one of Carpenter's separating calorimeters, which had been thoroughly standardized in the steam engineering laboratory of the University of Wisconsin. Readings of this calorimeter were taken seven times during the test. It was attached next to the throttle valve of the engine, the sampling pipe extending more than half way through the steam pipe. The condensed steam was lifted by the air pump through a temporary pipe connection up into one of two barrels from which it was run into another barrel placed on a scale where the water was weighed. The lower barrel was nearly filled eight times, as will be seen from the table. The pressure guages and vacuum guage had been calibrated previously to the test in the laboratory of the University and were found to be correct. The readings of the guages were as given in the table; but because of the position of the guages and the places of connection of the same with the discharge and suction mains the actual head against which the water was pumped was 211.3 feet.

No mishaps of any kind happened during the entire test, so that the results obtained can be relied upon as accurate. They are certainly satisfactory, and I desire to add here, that some tests which some of the senior students in mechanical engineer-

ing have made with the new pumping engine since the test was made, upon which I have reported here, conclusively show that with increased speed the pump will give a still higher duty.

Yours truly,

STORM BULL,
Mayor.

Number of Revolutions.	Discharge pounds per square inch.	Suction. Inches at Mercury.	Steam pressure, pounds per square in.	Time.
38,880	79	5.5	125	12:15
39,075	80	5.75	124	12:20
39,282	81	6.25	128	12:25
39,479	81	6.25	127	12:30
39,673	81	6.5	123	12:35
39,860	82	6.5	127	12:40
40,056	82	7.	125	12:45
40,240	84	6.75	124	12:50
40,404	90	6.75	126	12:55
40,626	82	7.50	127	1:00
40,819	81	7.25	124	1:05
40,997	81	7.	125	1:10
41,212	81	7.50	126	1:15
41,412	81	7.50	126	1:20
41,599	80	7.50	126	1:25
41,793	80	7.75	126	1:30
42,003	80	8.	126	1:35
42,199	80	8.	124	1:40
42,406	80	8.25	129	1:45
42,603	80	8.50	125	1:50
42,786	80	8.50	128	1:55
42,995	80	8.50	125	2:00
43,200	80	8.50	124	2:05
43,410	80	8.50	128	2:10
43,598	80	8.50	126	2:15

Total number of revolutions........................ 4,718
Average pressure at discharge........ .... 81.04 lbs.
Average vacuum in suction........................ 7.38 inches Mercury.
Average steam pressure.......................... 125.8 lbs.

CALORIMETER.

Lbs. of steam used.	Lbs. of water separated.	Per cent of water.	Time.
5.02	.175	3.39	12:20
5.10	.180	3.4	12:37
5.05	.170	3.26	12:55
5.05	.170	3.26	1:15
5.05	.171	3.26	1:30
5.20	.183	3.46	1:45
5.10	.175	3.32	2:00

The average per cent. of water contained was 3.335 per cent.

WEIGHT OF CONDENSED STEAM.

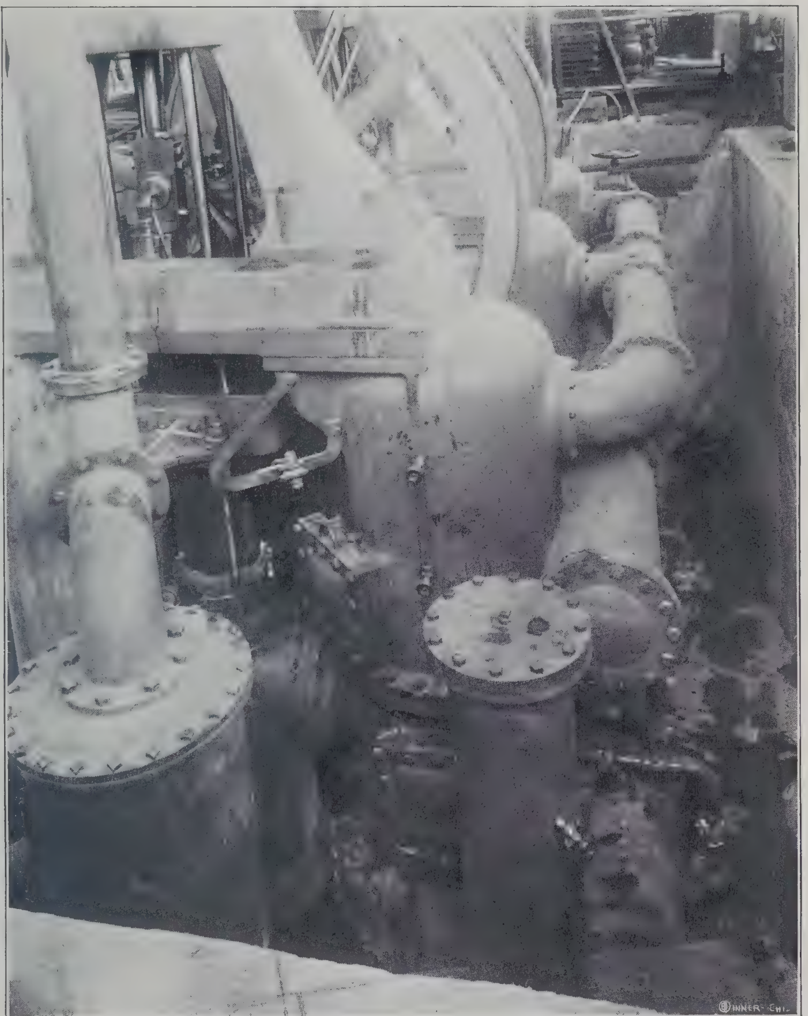
Total.	Tare.	Net.
432.5	82	350.5
450.0	85	365.0
439.0	84.5	354.5
440.5	84.5	356.0
447.5	83.0	364.5
446.5	85	361.5
307.0	84	223.0
300.0	84.5	215.5

Total steam condensed, 2,590.5 lbs; of which 96.665 per cent was dry steam, or in all, 2,504.1 lbs of dry steam.

WATER SUPPLY.

Our situation is not different from other cities, that are outside of a gravity system and when depending upon an abundance of water and pumping machinery, to furnish the same. The wealth of our country brings with it more luxuries so that the ordinary man can enjoy them. This has added more water takers on an average than heretofore, and with more and better water conveniences, calling for more water. It keeps the water departments constantly on the *qui vive*, either looking for more water or compelled to add new pumping machinery, or both. Our water supply being from artesian wells, and as known, limited, it has always been a serious problem. The daily capacity of our wells is 1,600,000 gallons. Last summer during the great drought, we pumped as high as 1,440,000 gallons a day. We were hardly able to fill our storage basin over night, to meet the enormous task made upon us the following day. We have nearly 3,000 water takers, with a great many beautiful lawns and an abundance of trees, which the water takers endeavored to save. This with over thirty miles of macadamized streets which required continuous sprinkling, taxed us to the utmost limits at times during the day. Only for the meter system, we would be at a loss what to do. Unfortunately your honorable body, before looking for more water, was compelled to first add new pumping machinery for fire protection on account of the inner parts of the old pumps being destroycd by the water. and a liability to break down with an increased fire pressure. We now have the pumps but not the water. This important step for more water must be taken at once. Adding more wells will not help us very much. Another year the same as last and we will be in the same dilemma.

The application of an air lift or compressed air application in the raising and increasing the supply of water from artesian wells has been in vogue and with success in many cities. At first, as your investigation of some years ago showed, the conclusion arrived at, that we would not have the desired effect expected, and very expensive in operation.



THE PUMPS IN THE PIT UNDER CONSTRUCTION.

Since then the system seems to have reached a state of perfection, that it probably would not be amiss to make a test for several weeks with well No. 3, as to results, carrying the water into the reserve basin for the pumps. The expense would probably be between 300 and 400 dollars. This would show what effect it would have on the other wells on the grounds, and what increase in the water supply we could expect. Our well casing of each well is down to a depth of 218 feet. We would therefore have to carry the drop pipe at least from 300 to 400 feet deep. I would recommend that measures be taken forthwith to make this test. Even if the air lift system will be a success and double our present water supply, your honorable body will have to prepare for the future. If the increase in the number of water consumers increases from year to year as in the past five years, which I believe they will, our water supply will again become inadequate. I would therefore recommend that if the air lift system is a success and adopted, that we proceed and build soon thereafter another reserve basin of at least 500,000 gallon capacity to store the water by the air lift system at night and to be drawn from in day time. After this basin is complete, enlarge the present basin to the same capacity.

I would also recommend that as soon as the funds allow, that an independent lake connection be made. The water main to be laid on North Hamilton street to Webster and Daytou street, carried along these streets to Doty and Fairchild street, joined together on these streets, with the necessary hydrants. I would then run a feed pipe on the four avenues to the Capitol park, and locate a four nozzle hydrant for fire protection. This would give ample fire protection for the business center of the city. The pumps connected with this main could be run by electric power, ready if an emergency calls. The cost to be incurred for this extension wonld probably reach the sum of $40,000. This lake connection could be made at once, if the property owners benefited thereby would be willing to share the burden of the expense with the city.

The cost would amount to about $1.75 per front foot.

ELECTROLYSIS.

The past year we made an examination of our water main near the power station of the electric light and power company. but did not discover any damage being done by the electric current. In the year 1894 an investigation was made as to the effect of electrolysis on our water mains, which did not show any great effects, but we took the precaution to bond our water main in five different places one thousand feet each way from the power house, by clamping the main and connecting a copper wire with the same to the connection between the rails. This seems to have been effective, and avoided the troubles with which so many cities are afflicted. The soil is also probably in our favor. It is certainly a great relief, judging from what other cities are suffering.

STREET SPRINKLING.

This is one of the most serious obstacles we have to contend against. To make the city healthful and free from dust. it requires street sprinkling. And to allow the fire hydrants to be used for this purpose, seems a criminal act. The danger from the fire is still greater on account of the misuse of the hydrants, than on account of the shortage of water.

This is the conundrum that baffles. So far everything has been done by the water department that laid in its power to assist in furnishing the water, thereby taking the chances, and bore the expense of repairing the hydrants which are constantly out of repair through the misuse of the street sprinklers. In the midst of our troubles the past year, I presented to your honorable body a special report under date of August 7, in which I called your attention as follows: "Your honorable body ought to refuse the street sprinklers to take water for street sprinkling from the hydrants; and compel them to go to the lake. The water is too precious to be wasted as it is on the streets, thereby crippling our fire protection. Different pumping stations can be erected along the shores of both lakes, that can be controlled by electricity, with no restriction

in the sprinkling during a heated term. With the street sprinklers and water motors cut off, there will be no interference with the water pressure, and we will always be ready for a fire."

No action was taken then and not as yet, and soon the contracts for street sprinkling will have to be awarded for the coming season. Standpipes could be erected all over the city with 1½ openings, but these would be a greater nuisance for water puddles and more unsightly. The best remedy thus far that has occurred to me, until complete arrangements are made, is to employ a special man for each cart, to handle the hydrant, and who is responsible to the city. The street sprinkler to be strickly forbidden under a penalty to handle the hydrants. The expense of these men to be borne by the property owners for whom the sprinkling is done. This would add about $250 to a sprinkling district, and would amount to only a trifle for eaeh party paying for the same. The petition for street sprinkling and contract with the city should be worded also, that the petitioner waives all right of any unavoidable shutting down of sprinkling streets with city water in case of an emergency or shortage of water. The same as all large contractors are obliged to do, in case of unforseen accidents or strikes. Action on street sprinkling should be taken at this meeting.

WATER METERS.

During the past year we increased our water meters from 2586 to 2807. An average increase of 221. Of these 208 were for new and 13 for old takers.

We are gradually connecting those without meters as soon as they connect with the sewer system. The proper course to pursue would be to connect all takers if possible this year. Advantage was taken by a great many of these takers the past season in sprinkling their lawns, which would not have been done if they had had a meter, and an injustice to the takers under the meter system. The total amount expended for meters of all sizes, (the city furnishing the meters free to the taker, including the meter boxes, and the placing of the meters

free at the introduction of the meter system by the water dedartment in 1838–9) up to September 30, 1901, was $46,096.85, an average of $16.89 for each meter.

The past year we consumed, having 2,966 takers, 1,576,499 pounds, or 788¼ tons of coal, which is 67 tons more than the previous year, with 208 additional water takers, and an excess in pumpage over 1899–1900 of 51,856,550 gallons of water, an average of 541⅔ pounds for each taker.

In 1884–5 with only 699 water takers, without the meter system, we consumed 605 tons of coal, or 1,731 pounds of coal for each taker. A difference of 1190⅔ pounds less per taker the past year. This means a saving the past year, calculating only at the same pumpage as in 1884–5 with no sewer system and sprinkling of streets and 2,267 more takers, $3.60 per ton of coal. (contract price the past year) of $4,851.83. Adding this amount to the amount saved up to last year of $45,407.35 deducting the cost of meters as above, viz—$46,096.85, leaves a surplus of $4,162.33 over and above the cost of the meters. The past year we pumped 331 gallons of water for each taker against 781 in 1884–5.

Without the meter system the past season, we would have been in a most chaotic condition. It was certainly a most fortunate undertaktng, when the city of Madison adopted the general meter system.

The per capita for all water pumped calculating on a population of 20,000, was 49 gallons per day. Ten hundred and sixty-four water takers paid only the minimum meter rate of $2.25 at the January payment, and twelve hundred and fifty at the July rent day. The meter repairs for the past year, exclusive of those broken by frost, for which the consumer pays, was $72.00.

The following table shows the number of meters in use for each year since October, 1884, the amount of water pumped, coal consumed, population and the per capita based on all water pumped:

Year.	Population.	No. of takers.	No. of meters.	Gallons water per year.	Gallons water per day.	Pounds coal per year.	Pounds coal per day.	Gallons per capita.
1884-85	11,325	699	3	199,333,840	546,120	1,210,150	3,315	48
1885-86	12,063	876	5	236,649,850	648,355	1,339,900	3,671	53
1886-87	12,063	980	5	261,308,160	715,885	1,124,200	3,123	59
1887-88	12,063	1,099	210	257,682,300	704,050	1,047,200	2,861	58
1888-89	12,063	1,229	385	195,450,770	535,480	914,500	2,540	44
1889-90	12,063	1,355	441	190,810,910	520,030	1,331,500	3,648	43
	Census 1890.							
1890-91	13,246	1,405	498	197,889,450	542,162	1,044,000	2,860	38
1891-92	13,246	1,554	547	226,035,800	646,753	1,173,100	3,214	47
1892-93	13,246	1,701	673	268,246,300	734,921	1,302,200	3,567	50
1893-94	13,246	1,820	795	272,006,950	745,224	1,393,800	3,819	48
	Census 1895.							
1894-95	15,950	1,994	1,223	313,705,500	859,467	1,514,400	4,152	53
	School Census.							
1895-96	17,884	2,186	1,726	325,408,500	891,530	1,558,000	4,268	50
1896-97	17,884	2,334	2,071	290,972,750	797,186	1,470,600	4,029	45
1897-98	17,884	2,473	2,269	279,016,500	750,730	1,470,200	4,028	41½
1898-99	17,884	2,606	2,410	291,934,250	799,819	1,440,000	3,945	40⅔44½
	Census 1900.							
1899-00	19,164	2,758	2,586	306,639,450	837,338	1,441,600	3.950	43⅔
1900-01	19,164	2,966	2,807	358,494,000	982,175	1,576,400	4,319	48

The following table shows the number, size and kind of meters in use October 1, 1901.

Kind.	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.
Crown	1,978	71	21	2	2	1
Hersey	224	128	4	......	4	....
Thompson	115	....	......	......	......	....
Westinghouse	20	....	......	......	......	....
Union	10	....	......	......	......	....
Nash	2	2	......	......	......	....
Trident	219	....	1	......	......	....
Worthington	....	2	......	......	......	1
	2,568	203	26	2	6	2

METER RATES.

First 5,000 cubic feet or less, per six months, per hundred cubic feet, 20 cents.

Over 5,000 cubic feet and up to 20,000 cubic feet, per six months add $10.00 for first 5,000 cubic feet and 10 cents for each additional 100 cubic feet.

Over 20,000 cubic feet and up to 30,000 cubic feet, per six months, add $25.00 for first 20,000 cubic feet and 5 cents for each additional 100 cubic feet.

Over 30,000 cubic feet and up to 30,000 cubic feet, per six months, add $30.00 for first 30,000 cubic feet and 3 cents for each additional 100 cubic feet.

Over 60,000 cubic feet and up to 90,000 cubic feet, per six months, add $39.00 for first 60,000 cubic feet and 2 cents for each additional 100 cubic feet.

Over 90,000 cubic feet, per six months, per 100 cubic feet, 5 cents.

Minimum per six months, $2.25.

The wisdom of collecting water rents under a scale and minimum rate instead of a flat rate, being often questioned, I have taken considerable pains to look into the matter as to the best course to pursue from a business point of view. In fairness to all concerned, I will give your honorable body the results of my labor.

In the first place, look where you may, touch on every article that is sold or purchased in the commercial world, and you will find a minimum and a scale rate. Take for instance all food products that enter into our daily life. The buyer that buys large quantities, gets his goods at a lesser price than the small buyer. The same is the case with the party that sells.

I touched on this subject in a general way in the fourth annual report, but I did not enter the daily transactions of the commercial business. I will show that all rates charged are under a minimum and a scale rate.

Under the first head we will take up the United States, and treat on postage and money orders.

(a.) Rates of postage.

Postal cards whether you write one or more lines costs one cent.

All letters whether you write one or a hundred lines weighing one ounce or less, costs to all parts of the United States,

Canada and Mexico, two cents. Here is your minimum, but the United States has no scale rate on letters, as for every ounce or fraction thereof, we have to pay an additional two cents. Newspapers and periodicals can be mailed by the public at the rate of one cent for each four ounces or fraction thereof.

Publishers and news agents can send them at a lesser rate, viz: one cent per pound. Then there is a third and fourth class rate.

(b.) Fees charged for money orders.

For orders for sums not exceeding	$2.50,	3 cents.
Over $ 2.50 and not exceeding	$ 5.00,	5 cents.
Over $ 5.00 and not exceeding	$10.00,	8 cents.
Over $10.00 and not exceeding	$20.00,	10 cents.
Over $20.00 and not exceeding	$30.00,	12 cents.
Over $30.00 and not exceeding	$40.00,	15 cents.
Over $40.00 and not exceeding	$50.00,	18 cents.
Over $50.00 and not exceeding	$60.00,	20 cents.
Over $60.00 and not exceeding	$70.00,	25 cents.
Over $75.00 and not exceeding	$100.00,	30 cents.

Minimum is 3 cents.

Here we have a minimum and a scale rate.

(c.) Express rates to Milwaukee, Wis.

3 pounds or less,	25 cents.
3 to 5 pounds,	30 cents.
5 to 20 pounds,	35 cents.
20 to 25 pounds,	40 cents.
25 to 40 pounds,	45 cents.
40 to 45 pounds,	50 cents.
45 to 50 pounds,	55 cents.
50 to 55 pounds,	60 cents.
55 to 60 pounds,	65 cents.
60 to 70 pounds,	75 cents.
70 to 100 pounds,	75 cents.

All over 100 pounds ¾ cents a pound, 1000 pounds, $7.50.

Here is a minimum and a scale rate.

(d.) Freight rates to Chicago on merchandise.

First class 40 cents a 100 pounds. Carload of 20,000 lbs. $27.40. Every commodity has a different rate, as for instance, cast iron pipe 10 cents a 100 pounds, or 5 cents a pound for a carload of 30,000 pounds.

Minimum 25 pounds or less, 25 cents.

(e.) Telegraph.

Ten words or less 25 cents; each additional word over ten, two cents.

(f.) Telephone.

To Milwaukee, fifteen cents a minute; to Chicago. three minutes or less, 75 cents.

(g.) Gas and Electric.

Price on gas is fixed to cover the minimum and meter rent. If paid before the 10th of each month the rate is $1.25 net for fuel, and $1.50 net for illuminating gas.

Electric lighting has a minimum and scale rate.

No bill for incandescent lighting will be made for less than $1.00 per month. From 100 to 26,000, 16 cents; from 26,000 to 52,000, 14 cents; from 52,000 to 78,000, 12 cents; for 78,000 or more watts, 10 cents.

(h.) Newspaper advertising rates for daily paper. A very complete scale rate as the following table shows:

	1 inch.	2 inches.	3 inches.	4 inches.	¼ column	½ column	1 column
One day......	$ 50	$ 75	$1 00	$1 25	$1 50	$2 00	$4 00
Two days	75	1 25	1 50	1 75	2 00	2 50	5 00
Three days ..	1 00	1 75	2 00	2 25	2 50	3 00	6 00
One week	1 75	3 00	3 50	3 75	4 00	5 00	10 00
Two weeks ...	2 50	4 50	6 00	6 50	7 00	9 00	18 00
One month ..	3 50	6 50	9 25	11 50	13 00	17 00	33 00
Two months..	5 00	9 00	13 00	16 00	20 00	30 00	50 00
Three months	6 50	11 50	16 00	20 00	25 00	40 00	60 00
Six months...	10 50	19 00	25 00	32 00	48 00	76 00	115 00
One year.....	19 50	31 00	40 00	50 00	72 00	105 00	160 00

Special rates will be given for large space to be used within a given time, the minimum price being ten cents an inch.

As an illustration, if same charge of one day for an inch at 50 cents each day would be made for thirty days, it would be $15.00, whereas the charge for one month is only $3.50. If the rate of $3.50 per month for six months would be the fixed price it would be $21.00, but the charge is only one-half of that, and the ratio for one year is $19.50 instead of $21.00 at the six months rate, etc.

Thus it will be seen that every business enterprise as well as every profession has a minimum and a scale rate, as also in

wheat, oats, corn, liquors, cigars, etc. Why should water be sold any different?

The selling of water is a business transaction and the amount to be collected for the same should cover the operating expenses, the interest on the bonds, and the interest on the investment; and arranged equally among the takers.

The average cost of the operating expenses for each taker the past year was $3.71. Interest on bonds average each taker thirty cents. Interest on the investment of $349,871.00 at 4 per cent., $4.72. Average total for each taker $8.73. Amount we collected was $9.44 for each taker, or only $2.128.33, less than two-thirds of 1 per cent. over and above the amount that ought to be collected for each taker.

In New York city there are 37,000 water meters in use. and the revenue derived from water registered by them in 1901 was $2,700,000, or $73.00 for each taker, against our $9.44.

Our rates could certainly be not much less, to meet all our obligations. Still it is said our rates are high and we ought not to have a minimum. What would be the result without the minimum?

To be able to judge, it is well to give the actual amount of cubic feet that was consumed by the takers. The past year we had two takers that would have paid the city for the actual use of water at the January payment less than 20 cents for six months, and seven at the July payment less than 20 cents.

January Payment, Six Months.		July Payment, Six Months.	
40 takers less than	$0 40	79 takers less than	$0 40
84 " "	60	136 " "	60
106 " "	80	154 " "	80
127 " "	1 00	148 " "	1 00
128 " "	1 20	151 " "	1 20
119 " "	1 40	120 " "	1 40
96 " "	1 60	121 " "	1 60
81 " "	1 80	111 " "	1 80
112 " "	2 00	85 " "	2 00
107 " "	2 20	95 " "	2 20
62 " "	2 25	43 " "	2 25

These takers consumed only 1,437,242 cubic feet, at 20 cents a 100 cubic feet it would amount to only $2.874.48 or $2.48.½ per annum for each taker. How could the city exist under such small payments?

280	takers paid less than			$3 00	267	takers paid less than			$3 00
304	"	"	"	4 00	232	"	"	"	4 00
214	"	"	"	5 00	171	"	"	"	5 00
132	"	"	"	6 00	132	"	"	"	6 00
105	"	"	"	7 00	90	"	"	"	7 00
53	"	"	"	8 00	78	"	"	"	8 00
64	"	"	"	9 00	61	"	"	"	9 00
37	"	"	"	10 00	34	"	"	"	10 00
181	paid from	$10 to		25 00	194	paid from	$10 to		25 00
17	"	25 to		30 00	13	"	25 to		30 00
15	"	30 to		60 00	14	"	30 to		60 00
4	"	60 to		90 00	3	"	60 to		90 00
Only 4 takers got the benefit of the five cent rate.					Only 5 takers got the benefit of the five cent rate.				

Thus we can see that 1891 of our water takers paid less than $10.00 a year or only 50 per cent of the water rent and the other 1075 takers paid 50 per cent.

If the minimum and scale rate would be abolished and the flat rate adopted, it would mean, to get same results, 15⅓ cts. per 100 cubic feet. That would diminish the average per taker to $1.90.

One water taker would have paid the city at that rate 16 cts. a year. Another taker 24 cts. Seven takers at an avarage of 26 cts. Forty takers 51 cts. Eighty-four 88 cts. One hundred and six at an average of $1.07. One hundred and twenty-seven $1.31. One hundred and twenty-eight $1.67, a year and so on. The highest amount paid would have been by 43 takers at an avarage of $3.42. The total sum collected from the 1157 takers that used less than the minimum would have been only $2.203.77.

By the adoption of the flat rate the city would naturally lose twenty-two consumers who alone would pay more than the 1157 viz: $2.567.70. That would compell the city to increase the rate per 100 cubic feet, and that would drive out the next larger consumers, and still increase the rate. Eventually the small takers would have to carry the burden.

Thus it will be seen, that the poorest policy that could be

adopted, and one that would give the water works the death knell, would be a flat rate.

I know of only one city that has a flat meter rate and no minimum, that is Milwaukee, Wis. The result of which is that a year ago the city had to come to the rescue of the water fund in the sum of $76.000.00.

Do we want to follow in such footsteps? When our meter rates are already as low as can be found. 1157 takers paying the city only $4.50 per annum, and 273 takers less than $6.00 per annum. These 1430 takers being nearly one half of our water takers.

Aside from the above, it costs as much to take care of a consumer that pays the city only $2.25 for six months, in looking after his interest, reading and repairing the water meter, flushing of main, repairing of the service pipe in case of a break, in fact it repuires just as much labor to take care of a small taker as it does of a large taker, that pays the city as high as $281.96 in six months, or $523.56 a year as does the Park Hotel, against $4.50 a year for the small consumer.

WATER PERMITS.

During the past year we issued 208 water permits as against 152 the previous year, making a total number of takers September 30, 1901, 2966. Calculating on an average of six takers on a population of 20,000, would mean that there are only 367 families without the city water.

WATER RENTS.

The annual revenue from the 2966 water takers was $28.021.51. an increase of 2,168.12. over last year. From permits $434.00 a total of $28,455.51. The average water rent collected from each taker would amount to $9.44.

OPERATING EXPENSES.

The operating expenses for the year ending September 30, 1901, were $11.010.10. This is $774.26 less than last year, due to the lesser price on coal over the previous year. The consumption of coal for the past year was only 134,800 pounds over the previous year, with 208 additional takers. Which

means 532 pounds of coal for each taker, against 508 pounds in 1899-1900. C. F. Cooley, furnished the anthracite pea coal for the year at $3.60 per ton. He being the lowest bidder.

The net receipts from water rents over and above the operating expenses the past year were $17,012.24. This was placed in the construction and repair fund. The average cost of operation for each taker, was $3.71.

CONSTRUCTION EXPENSES.

The expense of construction, extensions, service connections, meters, and the new addition to the pumping station, for the year was $17,710.83.

REPAIRS.

The repairs during the year amounted to $977.67. For the past nineteen years $12,368.71, or on an average of $650.98. per year.

SERVICE CONNECTIONS.

During the past year we laid 4,414 feet of extra strong lead services, adding the 36 taps mentioned below, of 921 feet, brings the number of feet of lead services laid to curbstone to 78,764 feet, or $14\frac{48}{5280}$ miles.

We also laid 201 feet of lead services to curbstone, wherever there is a possibility of an early connection with the premises, before the streets were macadamized, to prevent the tearing up of streets, when called for.

Thus far we have laid 17,247 feet of lead services to curb, which are not included in the summing up of the actual services in use.

These 17,247 feet mean 465 taps to be connected with, when applications are made for water.

Of these 465 taps, 36 were connected with premises the past year that called for water, reducing those taps to 429, and the 17,247 feet to 16,326 feet, which are now added in the summing up.

The following tables show on what streets service pipes were laid the past year for new takers, and those ready for connection when called for, giving size, number of feet on each street or avenue, and the total.

Table Showing Services laid for New Takers.

Streets and Avenues.	⅝ in.	¾ in.	1 in.	Total.
Baldwin	135	......	......	135
Bassett	33	......	......	33
Blair	76	......	......	76
Brearley	29	248	......	277
Brooks	48	......	......	48
Broom	19	......	......	19
Bruen	38	......	......	38
Carroll	......	11	......	11
Dayton	394	29	......	423
Dickinson	96	......	......	96
Doty	19	......	19	38
Few	48	20	......	68
Francis	67	......	......	67
Gilman	58	58	......	116
Gorham	249	......	......	249
Hancock	106	......	......	106
Henry	76	20	......	96
Howard Place	......	3	......	3
Ingersoll	29	......	......	29
Jenifer	192	......	......	192
Johnson	327	......	29	356
King	......	......	48	48
Lake	48	......	......	48
Langdon	......	19	......	19
Livingston	30	30	......	60
Lorch	13	......	......	13
Main	201	......	......	201
Marion	48	......	......	48
Mifflin	202	......	29	231
Mills	124	19	......	143
Monona	30	......	......	30
Murray	38	......	......	38
Park	19	......	29	48
Patterson	29	80	......	109
Pinckney	19	......	......	19
Prospect Place	10	......	......	10
Rutledge	19	......	......	19
Sherman Ave	106	......	......	106
Spaight	116	......	......	116
University Ave	......	20	......	20
Warren	29	......	......	29
Washington Ave	105	......	......	105
Williamson	324	29	48	401
Wilson	68	......	......	68
Total	3,617	586	202	4,405

Table showing services connected with premises that were laid before macadamizing streets, and now receiving water through same.

Street or Avenue.	No. feet ⅝ Pipe.
Bassett	29
Blair	66
Broom	29
Dayton	66
Franklin	19
Gilman	58
Gorham	19
Henry	29
Jenifer	96
Johnson	116
Spaight	96
State	13
Warren	29
Washington Avenue	208
Williamson	29
Wilson	19
Total	921

Number of Taps, 36.

Table showing services laid to curbstone before macadamizing of streets to prevent tearing up for connections hereafter.

Streets.	Number of Taps.	Size. ⅝ Inch.	Number of Feet.
Blair	5	135	135
Mifflin	4	76	76
Total	9	201	201

NEW MAINS.

During the past year we laid 4,000 feet four inch, 4,620 feet of eight inch cast iron pipe for water main. Part of this eight inch main was carried through the Yahara river. In connection with these mains we placed seven hydrants and twelve valves. We also lowered the twelve inch suction main at the station in connection with wells Nos. 1, 2 and 3 down to the depth of the new sixteen inch suction, and connected them with the same for the new pumps.

The following table shows the extensions made during the year giving size laid, number of feet, and where hydrants and valves were placed.

Streets or Avenues.	Cast Iron Pipe.		Hydrants.	Valves.
	4 inch.	8 inch.		
Alley, bl. 4 University Additi'n	660 ft.	....	....	1-4 inch.
Frances street	....	....	....	1-4 inch.
Henry street	856 ft.	....	1-4 inch.	....
Howard Place..................	480 ft.	....	....	1-4 inch.
East Miffiin street	660 ft.	....	....	1-4 inch.
Monona street	320 ft.	....	....	2-4 inch.
Patterson street	332 ft.	....	1-4 inch.	1-4 inch.
Prospect Place	360 ft.	....	....	....
Washburn street	332 ft.	....	1-4 inch.	1-4 inch.
E. Washington avenue.........	....	4,620 ft.	4-4 inch.	4-8 inch.
	4,000 ft.	4,620 ft.	7	12

The cast iron main laid on East Mifflin, Monona and Patterson took the place of the temporary lead main, which was removed.

In the early spring we will continue the eight inch main on East Washington avenue to Milwaukee and North street, and return with the six inch main on Winnebago street to Water street.

We have all temporary lead mains now removed.

WATER WORKS ORDINANCE.

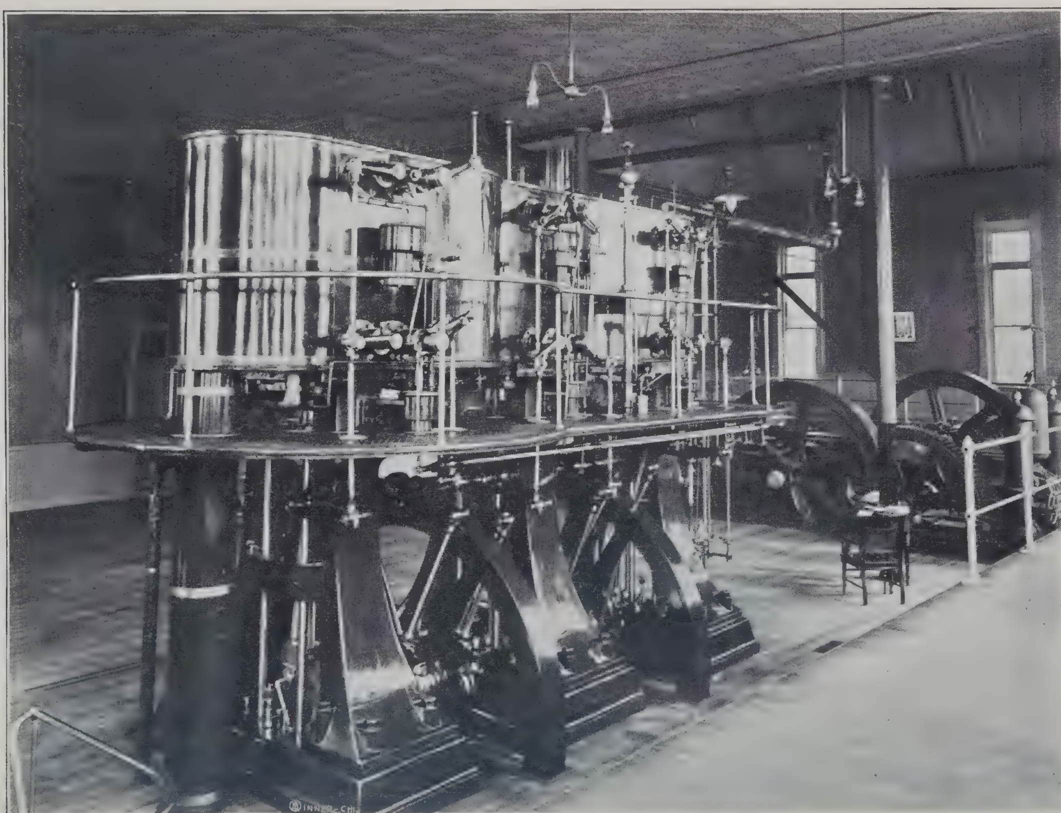
I would recomend that a committee be appointed to revise the ordinance and that the same be embodied in the report and several hundred copies be printed in phamphlet form. This is extremely necessary, the ordinance needs a great deal of revising to bring it up to date.

PUMPAGE RECORD.

Monthly record of the amount of water pumped and coal consumed during the year.

(PREPARED BY CHIEF ENGINEER, PETER GAUER.

Months.	Gallons of water pumped.	Revolution of large engine.	Revolution of small engine.	Average steam pressure.	Average water pressure.	Average Vacuum	Pounds of coal consumed.	Net combustibles.	Ashes.	Duties in foot lbs. per 100 lbs. net combustibles.
October, 1900.....	30, 206, 000	1, 373, 000	....	85	80	20	143, 300	120, 272	22, 928	46, 600, 618
November, 1900...	29, 294, 000	727, 000	1, 064, 000	85	80	20	123, 900	104, 076	19, 824	52, 823, 250
December, 1900...	23, 753, 500	649, 000	758, 000	85	90	17	110, 100	92, 484	17, 616	46, 572, 228
January, 1901.....	27, 654, 000	1, 257, 000	....	85	85	19	126, 500	106, 260	20, 240	52, 260, 176
February, 1901....	26, 552, 000	27, 000	1, 649, 000	85	85	19	120, 300	101, 052	19, 248	50, 456, 760
March, 1901	26, 839, 500	866, 000	623, 000	85	85	19	125, 800	105, 672	20, 128	48, 062, 271
April, 1901........	26, 668, 000	269, 000	1, 660, 000	85	85	19	116, 800	98, 112	18, 688	51, 667, 950
May, 1901	31, 042, 000	1, 411, 000	....	85	80	21	131, 500	110, 460	21, 040	50, 398, 110
June, 1901...	31, 825, 000	650, 000	1, 402, 000	85	78	21	130, 400	109, 536	20, 864	50, 876, 700
July, 1901	38, 406, 000	1, 248, 000	876, 000	85	72	24	152, 000	127, 680	24, 320	50, 173, 440
August. 1901......	35, 310, 000	1, 405, 000	....	85	75	24	156, 300	131, 292	25 '008	46, 416, 596
September, 1901...	30, 944, 000	1, 356, 000	89, 000	85	85	23	139, 500	117, 180	22, 320	50, 717, 300
Total..........	358, 494, 000	11, 681, 000	8, 141, 000	85	$81\frac{6}{10}$	$20\frac{1}{2}$	1, 576, 000	1, 324, 776	251, 224	49, 668, 783



THE NEW PUMPS COMPLETE.

Record of fires during the year.
(Prepared by Chief Engineer Peter Gauer.)

Date.	Time.	Duration.	Pressure at station.	Gallons of water pumped.	No. of box.	Extinguished by chemical or no water used.
Oct. 6, 1900	4:15 p m	....	....	....	18	No water.
Oct. 14	1:35 a m	....	....	....	54	No water.
Oct. 17	7:30 p m	....	....	....	27	No water.
Oct. 19	6:40 p m	....	....	....	18	No water.
Oct. 24	5:20 p m	....	....	....	14	No water.
Nov. 9	6:05 p m	....	....	....	26	No water.
Nov. 11	6:15 p m	....	....	....	12	No water.
Nov. 13	2:45 p m	....	....	....	26	No water.
Nov. 25	9:25 p m	0:14	90–95	14,000	18	
Nov. 29	2:00 a m	....	....	....	54	No water.
Dec. 1	11:25 p m	....	....	....	31	No water.
Dec. 7	5:40 p m	....	....	....	31	No water.
Dec. 9	2:45 p m	....	....	....	26	No water.
Dec. 13	6:03 p m	....	....	....	54	No water.
Dec. 16	12:35 a m	....	....	....	3	No water.
Dec. 17	6:35 p m	....	....	....	27	No water.
Jan. 21, 1901	10:40 a m	....	....	....	28	No water.
Jan. 22	6:00 p m	....	....	....	43	No water.
Jan. 27	7:00 a m	....	....	....	16	No water.
Jan. 29	1:35 p m	....	....	....	43	No water.
Jan. 30	11:45 a m	....	....	....	61	No water.
Feb. 12	5:35 p m	....	....	....	27	No water.
Feb. 17	12:10 a m	....	....	....	54	No water.
Feb. 21	10:05 a m	....	....	....	43	No water.
Mar. 17	12:10 a m	....	....	....	54	No water.
Mar. 21	10:05 a m	....	....	....	14	No water.
Mar. 21	9:05 p m	....	....	....	41	No water.
Mar. 22	6:30 a m	....	....	....	56	No water.
Apr. 22	12:20 p m	....	....	....	12	No water.
Apr. 27	5:45 p m	....	....	....	54	No water.
Apr. 30	2:35 p m	1:20	80–95	55,000	34	
May 22	1:35 p m	....	....	....	32	No water.
May 22	7:15 p m	....	....	....	41	No water.
May 28	4:20 p m	....	....	....	16	No water.
June 3	9:45 a m	....	....	....	54	No water.
June 13	10:45 a m	1:15	80–100	24,000	41	
June 20	7:50 a m	0:50	70-80	5,000	62	
June 25	10:20 a m	0:25	80–90	3,000	45	
June 27	11:50 p m	0:30	90–95	4,000	43	
July 4	11:20 a m	....	....	....	34	No water.
July 16	2:55 p m	3:00	80–100	110,000	31	
July 20	2:55 p m	....	....	....	21	No water.
July 23	11:15 p m	....	....	....	61	No water.
July 24	9:00 p m	5:50	80–95	89,000	18	
July 25	7:15 p m	....	....	....	63	No water.
July 26	8:25 p m	....	....	....	31	No water.
Aug. 3	7:15 a m	....	....	....	32	No water.
Aug. 9	7:50 p m	....	....	....	34	No water.
Aug. 15	3:05 p m	....	....	....	31	No water.
Aug. 16	12:15 p m	0:45	80–100	10,500	63	

Record of fires—Continued.

Date.	Time.	Duration.	Pressure at station.	Gallons of water pumped.	No. of box.	Extinguished by chemical or no water used.
Aug. 17 1901	12:45 p m	....	....	....	21	No water.
Aug. 25	1:10 p m	....	....	....	63	No water.
Aug. 28	5:25 p m	....	....	....	26	No water.
Aug. 30	2:50 a m	0:50	90–95	2,000	25	
Sept. 19	5:10 p m	....	....	....	54	No water.
Sept. 24	3:00 p m	0:35	90–100	3,000	24	
Sept. 29	4:20 p m	0:25	80–90	8,000	63	
Total	....	....	....	327,500		

RETROSPECT.

The nineteenth year of the existence of our water works has now passed into history. It is with satisfaction that we can review the magnificent work that has been accomplished during these years, notwithstanding the hampering and criticism that seems to be the lot of a municipal plant. The water works being the natural offspring of the city, it seems to come in for more than its share of fault-finding by would be philanthropists.

The object seems to be, to engender mistrust add to vilify the department, so as to hide the good work that has been accomplished. This may succeed for the time being, but murder will out, and right prevail.

The cost of the water works at the end of the fiscal year was $349,871.0,0 including the $76,000 invested in bonds at tee time of construction of which only $2,000 remains unpaid, and these will be paid the first of April of the present year. We have over 35 miles of mains, 175 hydrants and 246 valves. The total expenditure since construction was $349,871.00. This includes $41,604.88 for service connection to the curb; $46,069,85 for water meters, and $37,241.82 for ten artesian wells. The total expense for repairs was $12,386,61. New

boilers, $3,675.00, and the new addition to the pumping station, $5,200.00, bringing the sum total to $371,134.61.

No charge has been made to the individual owners of frontage property as in other cities, Aside from the above, the water department has paid over to the general fund, $7,000.00, and $8,000.00 to the bond fund.

Since 1896 it constructed and extended all its own work from the receipts, without calling on the city for aid from the tax levy, as provided in the charter.

The gross reeeipts from water rents since construction to October 1, 190I, were $312,953.72; from water permits, $7,-118.40; a sum total of $319,072.12. The operating expenses for the same period were $183,390.40, and for repairs, $12,-368.61, a sum total of $195,759.01. A surplus of $129,-313.11.

We now have 36 miles of water mains; 175 hydrants; 246 valves; 14½ miles of extra strong lead services, and 2,807 water meters in service.

MANAGEMENT.

Such splendid showing will impress a fair minded public, with what care and zeal your honorable body has managed the water department, notwithstanding the continuous criticism and fault finding of some citizens, who are only happy when they can degrade their fellow neighbor. The results accomplished, are your reward, and cannot be wiped out of existence.

CONCLUSION.

In closing this report, I take the occasion to express my grateful appreciation to each member of the board, for the valuable counsel and assistance rendered me in the discharge of my duties. With your kind aid in the future as in the past, my best endeavor shall be the continued success of the Madison City Water Works.

Herewith I also desire to express my gratitude to the secretary of the board, meter inspectors. chief engineer and assist-

ant engineers, firemen and laborers, for their kind assistance in the discharge of their respective duties, thereby aiding to to carry on the work to a successful accomplishment.

John B. Heim

Superintendent.

SUMMARY OF STATISTICS.

For the year ending September 30, 1901.

Population by census 1900	19,164
Date of construction	1881–1882
By whom owned	City of Madison
Source of supply	Artesian wells
Mode of supply	Direct pressure

PUMPING.

Pumping Machinery	Reynolds-Corless engines with Knowles pump combined
Description of coal	Anthracite pea
Price per ton	\$3.60
Coal consumed for the year in lbs.	1,576,400
Coal consumed for the year in tons	788
Total pumpage for the year in gallons	358,494,000
Difference between center of pump and guage	9 feet
Average static head against which pumps work	198 feet
Average dynamic head against which pumps work	221 feet
Cost of pumping figured on pumping station expenses per million gallons pumped	\$22.65
Per million gallons raised one foot (dynamic)	$10\frac{55}{221}$
Cost of pumping figured on total maintenance per million gallons	\$32.52
Per million gallons one foot (dynamic)	$14\frac{159}{221}$

CONSUMPTION.

Estimated population	20,000
Estimated population supplied	17,796
Total number of gallons pumped for the year	358,494,000
Average daily consumption in gallons	982,175
Number of takers	2,966
Number of meters	2,807
Average gallons pumped per day for each taker	331
Average gallons pumped per day per capita	49
Average pounds of coal consumed per day	4,319
Average pounds of coal consumed per year for each taker	532

DISTRIBUTION.

Kind of pipe used for mains	Cast iron
Size from 4 to 16 inches extended during the year	8,620 feet
Total now in use	$35\frac{5100}{5280}$ miles
Number of hydrants added during the year	8
Total number of hydrants in use	175
Number of valves added during the year	12
Total number of valves in use	246
Number of valves smaller than 4 inch	2
Number of blow off gates	2
Range of pressure on mains center of city	53 to 65 lbs. domestic
Total feet of cast-iron suction pipe	6,279

SERVICES.

Kind of pipe extra strong lead, size	⅝ to 2 inches
Extended	4405 feet

Total now in use	$14\frac{4844}{5280}$ miles
Number of services added during the year	208
Number now in use	2966
Number of meters added	221
Number of meters in use	2807
Percentage of services metered	98

CONSTRUCTION.

Cost of works to date	$349,871.00
Bonded debt to date	12.000.00
Rate of interest 4 and 5 per cent.	
Interest on bonds	500.00

FINANCIAL.

MAINTENANCE.

RECEIPTS.		EXPENDITURES.	
Balance bro't forward..	$7,233 92	Construction,	$12,510 87
Water rents,	28,021 31	Operating,	11,019 10
Water permits,	434 40	Repairs,	977 67
Miscllaneous,	5,537 10	Miscellaneous,	10,225 50
		Balance on hand,	6,493 59
Gross receipts,	$41,226 73		$41,226 73

ANALYSIS OF WATER.

	City Water.	Waukesha Bethseda Springs.
Potassium sulphate	0.237	0.454
Sodium sulphate	0.286	0.542
Sodium phosphate	Trace.	Trace.
Bi-carbonate of soda	1.094	1.256
Bi-carbonate of lime	15.224	17.022
Bi-carbonate of magnesia	12.984	12.388
Bi-carbonate of iron	0.214	0.042
Sesqui-oxide of aluminum	Trace.	0.122
Silica	0.414	0.741
Sodium chloride	0.292	1.100
Organic matter	None.	1.983
Total solid contents per gallon	30.745	35.710

INVOICE.

48 feet of 16-inch cast iron pipe.
12 feet of 14-inch cast iron pipe.
20 feet of 12-inch cast iron pipe.
48 feet of 10-inch cast iron pipe.
36 feet of 8-inch cast iron pipe.
120 feet of 6-inch cast iron pipe.
152 feet of 4-inch cast iron pipe.
40 feet of 3-inch cast iron pipe.
1 16x16x8 tee.
1 16-inch cap.
1 12x12x8 tee.
8 6x6x4 tees.
2 4x4x4 tees.
2 4x4x4x4 crosses.
1 8x6 Y.
1 8 to 6 reducer.
1 8 to 4 reducer.
2 8-inch offsets.
2 6-inch plugs.
6 4-inch plugs.
1 16-inch sleeve.
2 14-inch sleeves.
1 12-inch sleeve.
1 10-inch sleeve.
2 8-inch sleeves.
4 6-inch sleeves.
2 4-inch sleeves.
4 3-inch sleeves.
1 5-inch hydrant.
11 4-inch hydrants.
3 5-inch hydrant rods with valve attached.
9 4-inch hydrant rods with valve attached.
1 5-inch hydrant gate.
5 4-inch hydrant gates.
15 4-inch sockets.
4 5-inch sockets.
6 4-inch hydrant valves.
3 5-inch hydrant valves.
1 12-inch hydrant valve.
1 8-inch hydrant valve.
2 6-inch hydrant valves.
1 trench pump.
1 differential block.
2 valve boxes.
18 feet 9-inch well tubing.
56 street sprinkling valves.
6 tampers.
150 feet ¾-inch hose.
1 furnace and kettle.
24 sewer braces.
1 truck.
1 lawn mower.
1 three arm sprinkler.
1 6-foot chain tongs.
1 2-foot chain tongs.
19 ⅝-inch corporations.
6 ⅝-inch curb stops.
4 1-inch curb stops.
1 1½-inch curb stop.
1 Morse valve reseating machine.
2 21-inch wrenches.
1 16-inch wrench.

1 14-inch wrench.
1 10-inch wrench.
1 8-inch wrench.
2 6-inch wrenches.
1 22-inch trimo wrench.
1 16-inch trimo wrench.
1 14-inch trimo wrench.
1 8-inch trimo wrench.
2 18-inch star wrenches.
1 breast drill.
3 lbs. $\frac{1}{2}$-in. square duck packing.
2 lbs. $\frac{3}{8}$-in. square duck packing.
2 lbs. $\frac{1}{2}$-inch rawhide packing.
2 lbs. $\frac{3}{8}$-inch rawhide packing.
1 lb. $\frac{7}{8}$-inch piston rod packing.
6 lbs. $\frac{3}{4}$-inch piston rod packing.
3 lbs. $\frac{5}{16}$ valve rod packing.
2 lbs. $\frac{3}{8}$ valve rod packing.
6 lbs. 1 valve rod packing.
2 lbs. $\frac{1}{2}$ valve rod packing.
8 pump valves.
24 valve springs.
6 square feet $\frac{1}{8}$ in. rubber sheeting.
2 yards one ply rubber sheeting.
1 yard $\frac{1}{32}$ usudurian sheeting.
12 yards $\frac{3}{32}$ usudurian sheeting.
6 doz. machine wiping towels.
10 glass guages.
1 spirit level.
5 lbs. graphite.

METERS AND SPECIALS.

10 $\frac{5}{8}$-inch meters.
4 $\frac{3}{4}$-inch meters.
2 1-inch meters.
1 2-inch meter.
18 $\frac{5}{8}$-inch crown covers.
7 $\frac{3}{4}$-inch crown covers.
1 1-inch crown cover.
1 2-inch crown cover.
11 $\frac{5}{8}$-inch Hersey covers.
6 $\frac{3}{4}$-inch Hersey covers.
3 $\frac{5}{8}$-inch Hersey bottoms.
1 $\frac{3}{4}$-inch Hersey bottom.
4 $\frac{5}{8}$-inch Thomson bottoms.
9 sets $\frac{5}{8}$-inch Hersey plates.
1 set $\frac{3}{4}$-inch Hersey plates.
8 $\frac{5}{8}$-inch crown pistons.
6 $\frac{3}{4}$-inch crown pistons.
10 $\frac{5}{8}$-inch Hersey pistons.
5 $\frac{5}{8}$-inch Hersey piston rings.
3 $\frac{3}{4}$-inch Hersey piston rings.
5 $\frac{5}{8}$-inch Hersey intermediates.
24 $\frac{5}{8}$-inch crown intermediates.
9 $\frac{3}{4}$-inch crown intermediates.
9 $\frac{5}{8}$-inch Thomson intermediates.
7 $\frac{5}{8}$-inch crown straight reading gears.
2 $\frac{3}{4}$-inch crown straight reading gears.
1 1-inch Hersey rotary train.
1 2-inch Hersey rotary train.
8 doz. crown flange bolts.
6 $\frac{5}{8}$-inch Thomson rubber discs.
6 $\frac{3}{4}$-inch Thomson rubber discs.
1 $\frac{3}{4}$-inch Hersey dial.
1 1-inch Hersey dial.
1 $\frac{5}{8}$-inch crown dial.
1 $\frac{3}{4}$-inch crown dial.
1 $\frac{3}{4}$-inch Nash dial.
2 $\frac{5}{8}$-inch Thomson dials.
50 meter boxes.

FIRE ALARMS.

Signal of the fire alarm from bells and whistle are as follows, and is same number of blows as number of box.

SIGNAL BOXES.

Box.	*Location.*	*Box.*	*Location.*
3	—Fuller & Johnson Works.	41	—Main, Carroll and Hamilton.
12	—Wis. Av. and Gorham st.	42*	—Mills, and Mound, Greenbush.
14	—State, Gilman and Broom.	43	—Wilson and Broom.
16	—Mifflin and Broom.	45	—W. Main, at C. M. & St. P. tr'k.
18	—State, Dayton and Fairchild.	46	—Wash. av. and Brooks, Gr'nb'sh.
21	—Washington Av. and Franklin St.	51	—University Av. and Lake st.
23	—Dayton and Dickinson.	52	—State and Park.
24	—Johnson and Few.	53	—West Johnson and Park.
25*	—Gorham and Blount.	54	—University Av. and Charter.
26	—Johnson and Patterson.	56*	—Langdon and Frances.
27	—Gorham and Butler.	61	—Main and Blount.
28	—Pinckney and Mifflin.	62	—Jenifer and Bearly.
31	—Pinckney and Doty.	63	—Williamson and Livingston.
32	—Main and Hancock.	64	—Jenifer and Baldwin.
34	—Wilson and Blair; N. W. Depot.	65	—Atwood Av. and Winnebago.
35*	—King, Wilson and Butler.	71*	—Sherman Av. and Few.

INSTRUCTIONS FOR OPERATING FIRE ALARM BOXES.

Boxes with glass doors marked thus (Key inside.) Break glass, turn key, open door and pull down hook ONCE as far as you can and let go.

Open box, pull down hook ONCE and let go, do not jerk the hook down and up, but pull down steadily as far as you can and let go.

Stand by the box until the department arrives and direct them to the fire.

NOTICE.

Keys to boxes are kept at the three nearest houses, hanging outside, attached to a red tag.

Any telephone can be used to send an alarm. Call up Central Telephone Exchange and give them the exact location of the fire, they will repeat to Fire Stations.

Everybody should make themselves acquainted with the location of their nearest box.

Keep cellars and attics as free from combustible matter as possible.

There is a reward of $100 for the information leading to the conviction of parties turning in a false alarm.

TELEPHONE NUMBERS.

Central Station, No. 1—730.
Station No. 2—59.
Water Works Station—96.

SIGNALS FOR FIRE DEPARTMENT.

2 Two Taps—More pressure.
2 Taps repeated—Second alarm.
1 Tap—Fire out.

The tower bell will strike and the whistle will blow for No. 34—Three blows, a short pause, then four blows, after which a long pause. The whistle will give the alarm twice.

RULES FOR THE WATER METERS.

The following rules have been adopted by the Board of Water Commissioners to govern the use of water meters:

SECTION 1. All services which may hereafter be connected with the City Water Works system, and all services that are still without a water meter, shall be connected with the meter furnished by the city. All meters must be placed by a licensed plumber at expense of property owners, and as near as possible to where service pipe enters building. The plumber doing the work must flush pipe thoroughly before connecting the meter. The city will repair all meters that are clogged, and if lead chips are found to be the cause, a fine of $1 will be collected from the plumber doing the work for each and every job so found, before issuing another permit to said plumber. No water meter shall be removed or disturbed without first having obtained permission from the Superintendent of the Water Works.

SEC. 2. A check and waste shall be placed between the shut-off cock and meter, within one foot of the meter. All meters shall be so located and placed as to afford easy access thereto, and so that they can be easily examined and read. In all cases where meters have been ordered and have been supplied, no water from the City Water Works shall be taken, received or supplied to the building for which the same was constructed and intended, except that which shall pass through and be registered by such meter.

SEC. 3. The consumers of the water supplied through any water meter shall make all necessary repairs; when destroyed by frost, the City of Madison will make all such repairs at cost. A licensed plumber must remove and replace such meter. The expense of such repair shall be chargeable to such consumers, and shall be paid at the time such repair was made, and in case of failure to pay for such repair, the Superintendent of the Water Works shall shut off the flow of water furnished through such meter. No defective meter shall be removed without first having obtained permission from the Superintendent of the Water Works.

SEC. 4. In case that any water meter should fail to register the quantity of water passing through the same, the consumer will be charged at the rate of the average daily consumption registered by such meter the corresponding month of the previous year.

SEC. 5. In all cases where one service connection or yard hydrant does supply two or more separate consumers, premises, tenements, business houses, or a block occupied by divers parties, one meter only will be placed at the service connection of either or all of said consumers, and the water

rent as registered by said meter shall be chargeable to and payable by the owner of said premises or buildings. Parties desiring more than one meter must furnish them at their own expense.

SEC. 6. Water rents, where meters have been placed, shall be collected for the first six months and fraction thereof at the schedule rate, as it will require the registration of six months, that is, from one rent day to the next, to be able to get the amount to collect. Thereafter as per record of meter the preceding six months in a manner as prescribed in section 13 of water works ordinance, for each building, premises, or consumer. No rebate will be allowed. No water meter rental will be charged by the city of Madison. The rate of water rent to be charged where meters are in use shall be according to the meter rate established by these rules, the minimum whereof being in all cases two dollars and twenty-five cents ($2.25) per six months. Meters will be read monthly.

SEC. 7. The Superintendent of the Water Works system, meter inspectors, or any person employed by the Board of Water Commissioners, shall be given free and ready access to the premises and buildings for the purpose of examining or repairing any meter or connection therewith. Any and all meters shall be left in the condition and manner as set by the city, and shall not be interfered with in any manner whatsoever.

SEC. 8. In case of any violation of any of the foregoing rules and regulations, the water supply furnished to the consumer guilty of such violation shall immediately be shut off, and shall be resumed only upon a satisfactory adjustment of all the differences connected therewith, and upon the payment of the sum of one dollar for shutting off and turning on the water. Anybody violating any of these rules and regulations shall, upon conviction thereof, be subjected to a fine not to exceed twenty-five dollars ($25) and the cost of prosecution.


MADISON
AND
THE FOUR LAKE
STATE CAPITOL.
PARK HOTEL.
N
W
E
S
MENDOTA.
FOURTH
PICNIC POINT
MONONA
THIRD LAKE
WINGRA
STONE FACE
STATE HOSPITAL
ROCKY ROOST
GOV'S-ISLAND
MAPLE BLUFF
OAK LODGE
FOX'S BLUFF
WACONIA
BLACK HAWK
EAGLE HEIGHTS
STEAMBOAT DOCKS
UNIVERSITY BOAT HOUSE
EDGEWOOD ACADEMY
SCHUETZEN PARK
ELMSIDE.
ALLIS PLACE
WINNEQUAH
HOBOKENS BAY
LOUGEE'S SHOOTING BOX.
WAUBESA LODGES
CAMPS AND LODGES
SECOND LAKE
BROWN'S BLUFF
C.&N.W.R.R.
C.M.&ST.P.R.R.
8 MILES FROM CAPITOL